HIGH EXPLOSIVE SHELL MANUFACTURE

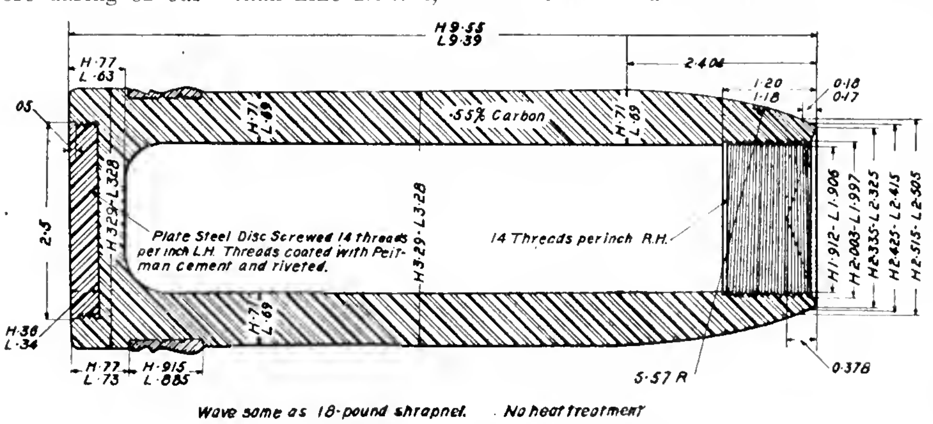
The sudden call from the manufacture of articles of a peaceful commerce to that of supplying the gods of war with provender of a prodigious amount and such as we never dreamed of producing, has been met by the administrations of our iron and steel industries in a manner that demands whole-hearted admiration for their enterprise, capacity, resourcefulness.

THE problems facing machine shops in Canada to-day are perhaps greater than any they have previously had to solve. Even the layman is not very hard pressed to imagine the troubles, difficulties, disappointments, and reverses that beset the inauguration of a new industry. When, however, this industry has to be developed on a large scale against odds that have combined themselves in such a way as to make the successful outcome almost impossible, it is surely a rare tribute to our manufacturers, their executive staffs and the workmen who have put the plans into being, that highly satisfactory results have been and are being attained.

The proposal to make shells for the British guns was placed before the Canadian engineering community with but scant notice. The more daring of our mechanical men, however, jumped at the opportunity to get into this work, being spurred on by two primary motives—first, the pariotic, and, secondly, the chance to get their plants running again at full capacity. Canada had been in the throes of a very dull industrial period, and thus, when new equipment came to be ordered, it was found that the machine tool manufacturers had but little to offer from stock, besides being in no way prepared to make good deliveries, because their plants were mostly all working on short time, and could not be put on full time at a moment's notice.

The large number of Canadian shops that went into the shell business fairly swamped the machine tool manufacturers with orders for equipment. Canadian orders were not, however, the only ones upon which the machine tool people were working, because huge orders from the European belligerent powers were also being placed with them. The result was that Canada found herself dependent upon her own resources more or less. Realizing this, our engineers and plant superintendents rose to the occasion and fitted up lathes and various other machines at their disposal to take care of shrapnel shell contracts.

Here, after a period of not longer than nine months, we find that the difficulties of making shrapnel shells have not only been surmounted, but our organization has been so perfected that a wonderful output is now being obtained. The ingenious methods adopted by our men in attaining this end have excited much admiration on the part of our American cousins, who themselves have earned a considerable reputation for smartness. However, the modesty of the Canadian engineer does not permit him to congratulate himself unduly, and anyway, were he so inclined now, it would be well-nigh impossible, because his shops are going night and day. Any spare time that falls to his lot is usually spent in obtaining a well-earned rest, and he is not much disposed to talk "shop."



BRITISH 18-POUNDER HIGH EXPLOSIVE SHELL.

High Explosive Shells.

Lately a new problem has been presented to our machine shops, involving the manufacture of the lyddite or high explosive shell. It must not be thought because the lyddite shell is in some cases of like diameter that it is similar in manufacture to the shrapnel. It is an entirely different proposition, and the purpose of this article is to point out the main differences. There are two sizes of lyddite shells now being manufactured in Canada—the 3.3-in. and the 4.5-in. shell. The former is known as an 18-pounder and the latter as a 35-pounder. These two shells each require a vastly different plant to that for shrapnel, also they are being machined along entirely different lines.

Let us take first the "three-point-

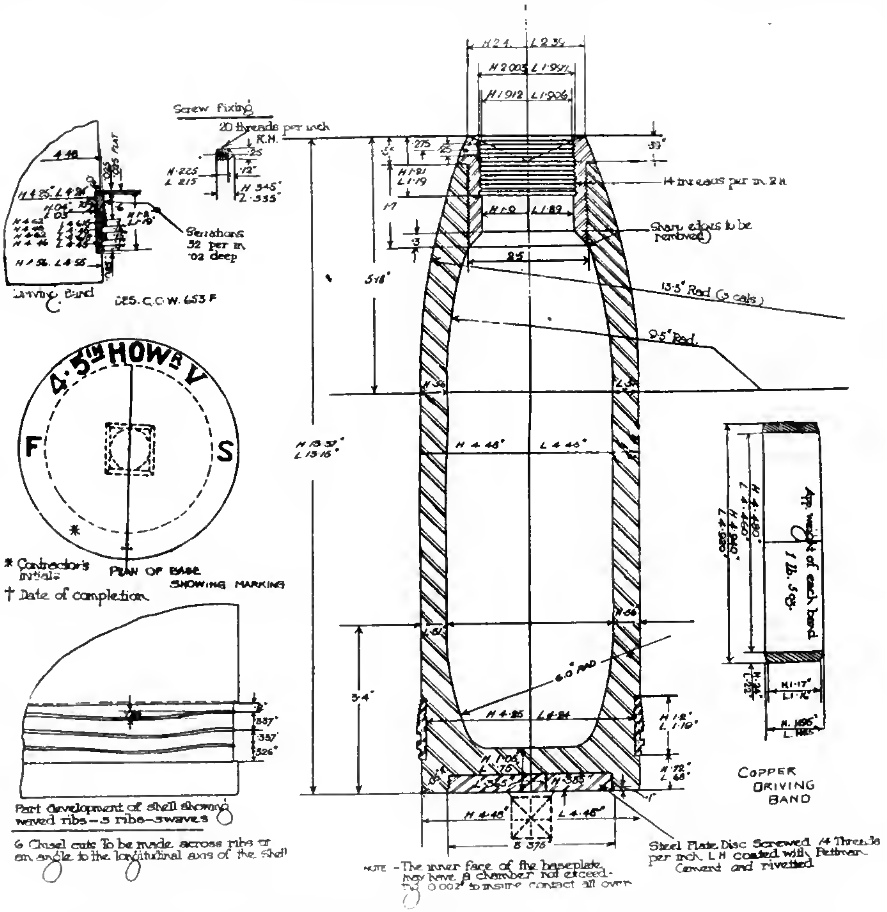
three'' lyddite shell. This finds its way to the machine shops, not as a forging, but as a piece of bar stock cut to rough length. The preliminary operations now in vogue in the various shops are almost identical, but differ from each other in sequence. The order of these operations, however, makes but little difference; therefore one of the most common series will be outlined.

The shell is centred, and is rough-turned the whole length with the exception of that portion upon which a driving dog is placed or a chuck grips it. The bar stock is about $3\frac{3}{4}$ inches in diameter, and the finished diameter is "three-point three" inches, so that nearly a quarter of an inch cut of metal has to be removed from each side of the bar. This metal is taken off and the base of the shell finish faced as far in as the tail centre will allow. The base end of the shell is then finish turned for a short distance, which distance is sufficiently far up to meet the driving band recess. Forming the radius on the corner of the base follows. All of the foregoing is done usually on one lathe.

The next operation is the machining of the driving band groove. Sometimes this operation is accomplished on the same lathe as the rough-turning, and in other cases it is accomplished on another machine. The groove is exactly similar to that on the eighteen-pounder shrapnel.

If this method of taking care of the primary operations has been followed, the next procedure is that of drilling out the shell interior. Rigid drill presses are used almost universally in this process. Sometimes a small drill is used to take a preliminary cut, but in many instances the large roughing drill is put down first.

In some shops drilling out the body is the first operation, the rough-turning being done with the shell mounted on an expanding arbor. When this plan is adopted, another operation is also accomplished, i.e., the machining of the recess in the base. This is possible because the end of the shell is not carried on a tail-stock centre.



Q.F. HIGH EXPLOSIVE 4.5 INCH HOWITZER SHELL, MARK V/L/, FORMED FROM STEEL BILLET 4.8 INS. DIA. BY $9\frac{1}{2}$ INS. LONG AND WEIGHING 49 LBS. WEIGHT OF FILLED SHELL 35 LBS. PLUS OR MINUS 9 DRS. WEIGHT OF BURSTING CHARGE (TROTYL), 4 LBS.

The reason for machining a recess in the base is not apparent to the casual observer, the idea, however, being to reinforce the base with a forged base plate. The shell case, it must be remembered, is made from bar stock, and there might be a pipe in the central portion. If this pipe did exist, it might, upon firing, ignite the high explosive charge in the shell before it left the muzzle of the gun, such a result being naturally very disastrous to not only the gun, but the gunners. The base plate is, therefore, a forging, and is screwed in the base recess very securely.

The next operation is the finish boring, the shell being bored the required depth and the bottom of the bore formed. A thread is also cut on the inside of the nose for about a distance of an inch and a half. This thread is cut from a bore the same size as the straight bore, therefore a recess has to be formed to relieve the thread cutter. The specifications call for this, and practice also demands it. This is a right-hand thread cut with fourteen threads to the inch. Taps have not been found to give equal satisfaction on this operation as they have done on the inside of the noses of shrapnel shells. As a consequence, the practice of milling the threads is receiving considerable attention at present, and gives promise of handling the job satisfactorily. Some firms have built small millers for this purpose, and a number of Canadian firms are also putting on the market a line of machines to accomplish this milling.

After being bored and the nose tapped, the shell passes on for the finishing and tapping of the recess in the base. The latter is tapped out for about three threads, and, here again, relief must be provided for the cutter. This base recess thread is left-hand, of fourteen threads to the inch, and is also being milled out rather than tapped. As an extra precaution, however, sizing taps are run down into both the nose and the base, these taps being usually specially made. The shanks are long and round, and pass through a guide bearing which is bored out of the same casting at the same setting as the locating portion of the chuck which clamps the shell solidly for this particular operation. Thus the tap can never get across a thread or spoil a shell.

Rough turning and forming the taper in nose of the shell, when the boring and the tapping of the nose is accomplished, are being featured; but this is, of course, determined by the nature of the tooling placed on the various machines.

The next operation is the finish turning and forming of the shell nose. This is accomplished on engine lathes in like manner to that employed on similar operations on the shrapnel shell. A forming cam is bolted to the back of the lathe and the cross-feed is disconnected. The cross slide has a fixture attached to it which registers against the formed cam, the cross slide being kept always in register by means of springs or by weights suspended from an attached wire rope. All adjustments of the tool are made by means of the compound rest of the machines.

No heat treatment is necessary with this shell. To many manufacturers this will be welcome, as considerable difficulty has been experienced with same in the production of shrapnel. However,

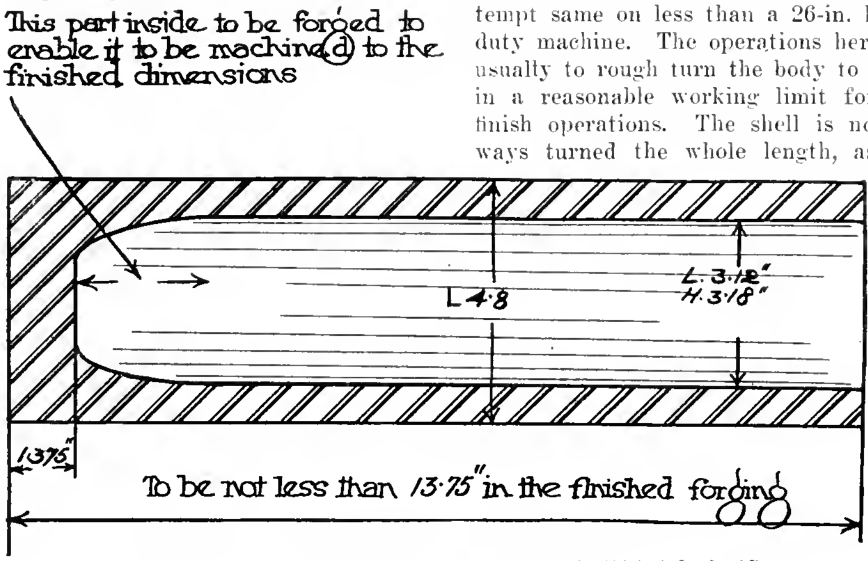
another operation is substituted which, to a certain extent, is as great a source of trouble, as far as the loss of time, at least, is concerned. This consists of varnishing the interior bore of the shell and placing the latter in an oven for a period of eight hours, during which period the shell must be kept at an even temperature of 300 degrees F. Various types of furnaces are in use, some of which are electric, others oil, and others gas, etc. As the heat is not excessive, no very great difficulties are experienced in the operation of these furnaces.

The copper driving bands are pressed on in a manner similar to that practised in the 18-pounder shrapnel shell, and the band turning is accomplished likewise.

4.5-in. Shell Production.

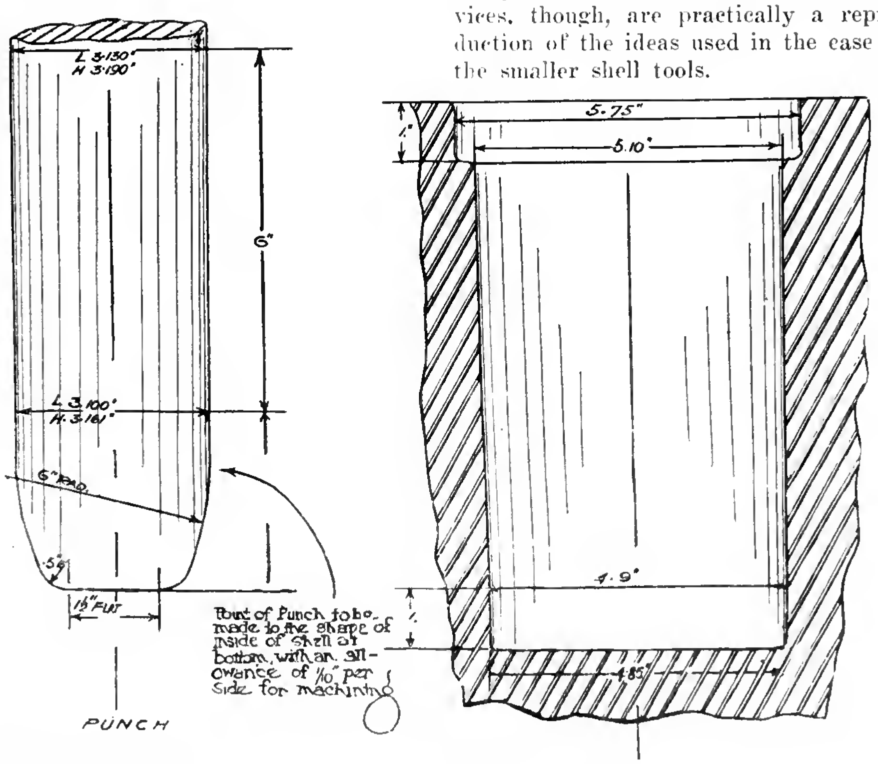
The "four-point-five" lyddite shell is received by the shops in the form of a forging and not as bar stock. The preliminary operations consist of cutting off the open end of the forging and rough facing the base end. This forging is heavier than one would imagine, and an especially heavy cutting off machine is required. A heavy lathe fitted with a special chuck very strongly made gives about as good service as any.

The facing of the base is done in two ways. If an expanding arbor be used in the rough-turning operation it is not probably necessary to have a centre in the base end, but, if the rough turning is done with a self-centering chuck, the outer end must be carried in a centre of some description. The outer end is often carried in a tail-stock centre, even if an expanding arbor be used to hold the shell in the case of the rough turning. The base of the shell must thus be faced in a lathe if a centre is to be carried. This operation cannot be performed on a milling machine or boring mill in a jig, as has been the practice with shrapnel shells.



Q. F. HIGH EXPLOSIVE 4.5 HOWITZER SHELL FORGING.

On account of the heavy turning, it is better to work with the outer end carried in a centre to absorb all spring of the tool and fixtures. The rough turning is accomplished on an engine lathe, and it does not seem very practical to attempt same on less than a 26-in. heavy duty machine. The operations here are usually to rough turn the body to within a reasonable working limit for the finish operations. The shell is not always turned the whole length, as the open end may be grasped in a chuck. The base end is usually finish turned up to the metal left on the base in which the centre is carried. This finish operation is, of course, carried far enough to be in that portion of the metal which is later removed when the recess in the base is cut out.



APPROXIMATE SIZES OF PUNCH AND DIE FOR 4.5 HOWITZER SHELL FORGINGS.

The shell is finish turned up as far as the driving band groove, then the radius of the corner of the base of the shell is formed. The driving band groove can be rough turned and formed here if wished. The tools are carried in a heavy revolving tool holder.

The shell is next bored, a heavy chuck being used for this work, placed on, say, a heavy duty 30-in. lathe. It is not advisable to use a smaller machine. Engine lathes are by far the best to use, a heavy turret being mounted on the cross slide. There should be four bars for boring. A roughing cutter should be put in to bore the straight portion of the bore from the nose inward. It may here be noted that 4.5-in. lyddite shells are bored all the way to the base and finished all over.

A roughing cutter should next be put in to form the bottom of the bore, these being formed cutters with two cutting edges. It helps to have them gashed for chip clearance. The finish cutters should not, of course, have chip clearances provided. The bars should be as rigid as possible, and it is right here, in this boring operation, that the greatest power and rigidity is needed.

After boring, the driving band groove is cut, the groove being considerably wider than the "three-point-three" groove. There are three waved lines in the bottom of the groove, these being formed from a three-point face cam on the face plate of the lathe. Quite as many devices for machining this groove have been developed and operated as have been in the case of the 18-pounder shrapnel and lyddite shells. All the devices, though, are practically a reproduction of the ideas used in the case of the smaller shell tools.

The next operation is that of nosing the shell. It has been found that it is rather expensive to heat the big shell in a lead pot. There is something in the neighborhood of three-quarters of an

inch of metal to heat and a great deal of lead is lost by oxidation. Oil furnaces seem to have become popular to accomplish this work, several being now on the market. To nose the shell, various sizes of presses have been recommended. It seems that a press of about 100 tons capacity is necessary, although some makers are advocating a press of 150 tons. Bulldozers and steam hammers have been more or less successfully employed, but just what type of machine will be the most popular is hard to suggest at the moment. However, the man who buys a hydraulic press of 125 tons capacity will not be left very far behind in the work, although there are no doubt many other press specialties that will give quite as good results. It is not considered necessary to even semi-anneal the noses after the bottling-in process, as the metal is so thick that there is not much tendency to chill.

The nosing of the shell is immediately followed by the finish machine operations on the nose. For a distance of an inch and one-half back, the nose is bored straight, then the shell is turned and formed inside. This has to be performed with much greater accuracy than the similar operation on shrapnel shells. The interior curve has to run into the straight bore very smoothly, and not the slightest semblance of a shoulder must be shown. The interior of the shell is later varnished and baked. This varnish or enamel is to keep the explosive lyddite from coming in contact with the steel shell, for when lyddite comes in contact with the steel a chemical action ensues, which destroys the explosive properties of the lyddite. Hence, all shoulders are to be avoided in the inside of the shell, these having a tendency to cause the varnish to flake and expose the steel.

The nose of the shell is finally faced and the outside of it rough turned and formed. To accomplish this, the shell is usually held in a chuck, which grasps it for nearly its whole length, and holds it rigidly. These operations are very similar to those on shrapnel shell. The straight bore of the shell is, however, much deeper than in the case of shrapnel, and this feature makes it rather difficult to tap-thread nose with a collapsible tap. As in the case of the recess in the base, the thread miller is here used to advantage.

In the boring out of the base, the shell is simply grasped in a long chuck and held there securely. Various types of tools are used to accomplish this work, which amounts to a simple recess about three-eights of an inch deep and 3⅜ inches in diameter. The thread is milled in the recess after a relieving groove has been cut.

Next the shell is finish-turned, a collet chuck being generally employed to grasp the shell base, and a threaded centre being screwed into the nose. This centre is supported by the tail spindle. The base of the shell has been finish-turned, as may be remembered, as far up as the driving band recess. A formed cam is attached to the rear of the lathe, and the cross slide disconnected. Weights suspended from wires attached to the cross slide keep the cross slide, which carries the tool, in register with the forming cam, and thus the profile of the nose is turned.

The copper band is next pressed on in machines similar to those used for the smaller lyddite and shrapnel shells. Then the bands are turned. The shell is chucked and a roughing copper band cutter is put into the work. Next a formed finish tool is used.

CANADIAN SHELL COMMITTEE.

The personnel of the committee entrusted with the placing of orders for shells, etc., and the inspection and shipment of same is representative of both Canadian military and manufacturing interests, and is individually as follows:

David Carnegie, M.I.C.E., Ordnance Advisor.

Col. Alexander Bertram, Chairman of Committee.

Brig. Gen. T. Benson, Master General of Ordnance.

Lieut.Col. Thomas Cantley.

Lieut.-Col. C. G. Harston, Chief Inspector of Arms and Ammunition.

George W. Watts.

Lieut.-Col. F. D. Lafferty, R.C.A., Supt. Dominion Arsenal.

E. Carnegie.

The Shell Committee Headquarters is Ottawa.

The base plates are next screwed in place, but first let us make mention of the machining of these forgings. The back of the disc is faced, leaving the centre about two thousandths higher than the edge, the latter being turned straight. Next the edge is threaded. Machines to accomplish this work at one setting are being designed. The thread is being in many cases milled, followed by sizing dies.

The base plates are screwed home with huge wrenches working on the square shank of the forging. Next the base plate is faced off flush with the base of the shell and peined. The shell is then varnished on its interior, and the varnish is allowed to bake in an oven for eight hours at 300 degrees F. The shell is afterwards removed from the furnace and the brass socket screwed in, the later being afterwards turned. The shell is next chucked and the brass socket formed to a curve, which is a continuation of the curve of the steel nose. When this operation is completed the shell is ready to be painted, after which it is ready for shipment.

SHELL SUPPLY—A PATRIOTIC OFFER.

THE Glasgow and West of Scotland Armaments Committee have received a most patriotic offer from G. & J. Weir, Ltd., Cathcart, makers of "Weir" pumps and other specialties, who have undertaken to produce an unlimited quantity of shells at net cost. The offer was contained in a letter signed by W. Weir, one of the directors and, in this it was pointed out that while it was proposed to establish a national shell factory in Glasgow, his firm had the nucleus organization and the necessary experience, so that it would be much simpler to increase their production than to organize an entirely new producing unit. The letter also quoted the following resolution, which had been unanimously adopted by the directors of the firm:—

"It is hereby agreed that until the conclusion of the war all profits arising from the manufacture of shells under present contracts, after deduction of the necessary allowances for establishment charges and capital expenditure, shall be handed over to certain of the various organizations carrying out relief work or Red Cross work which the war has necessitated, and which are supported by voluntary subscription. When the contracts in question are completed, the different shell plants will be available to produce shells for the Government at net cost, and if required all such future production shall be carried on in conjunction with the proposed Glasgow National Shell Factory."

The firm also offered to extend their plant and machinery for shell production, and on completion of present contracts to devote machinery and labor to the machining of shells produced by the proposed Glasgow National Factory, or generally to work in conjunction with the same under whatever conditions might be suitable.

The committee expressed its high appreciation of this spontaneous offer, and decided to bring it before the notice of the various interests concerned. Detailed information in regard to the proposed national factory was submitted to the committee, and the scheme was remitted to the Shell Sub-Committee for investigation and report.

H. E. Shells Displace Special-Purpose Machinery Output

Staff Article

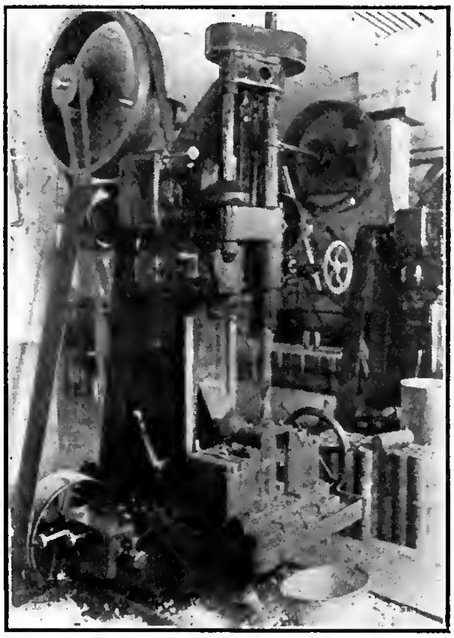
The plant which forms the subject of this article was among the first in Canada to undertake the production of 18-pdr. lyddite shells. Being accustomed, however, to manufacture machinery for special duty, little, if any difficulty was experienced in tackling successfully these war-time commodities. In addition to designing several ingenious fixtures and tools, a number of special machines have also been built and marketed for the work.

THE principal features with regard to the physical properties of high explosive shells having been dealt with more or less fully in another article, it is hardly necessary to reiterate here what has already been said. The manufacturing methods adopted at different plants vary according to conditions prevailing, and also according to the ideas of those responsible for the output administration. High explosive shell production is yet more or less in its infancy in Canada, and it, therefore, remains to be seen to what extent equipment and methods will ultimately become standardized.

As the industry develops, new methods and machine equipment and tooling will no doubt be introduced, and it is here where the chief interest lies, especially for those contemplating engaging in this business. The manufacture of high explosive shells is at present to some extent in the experimental stage, at least as regards some operations, although those concerns at present making this type of shell are obtaining satisfactory results. The whole question of making high explosive shells is full of interest and developments are sure to be followed closely. The pioneers in this business have shown considerable courage and resourcefulness, and are doing much to help those who for various reasons have not meantime got started.

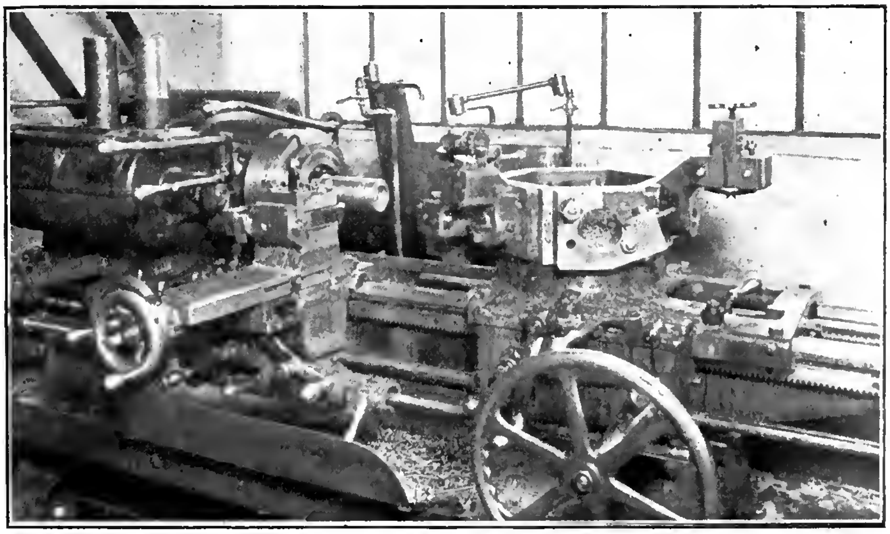
Drilling Bar Stock.

In a number of plants the initial operation consists of cutting the bar stock to the approximate length, but in this particular shop the operation is omitted at this stage, the bar being cut to length later. The first operation consists of drilling the hole in the bars, afterwards reaming out to the finished diameter with the exception of that part at the nose which has been threaded. Six high-speed vertical drilling machines are installed for this work, five furnished by Baker Bros., Toledo, Ohio, and one by the Foote, Burt Co., Cleveland, Ohio. The "Baker" drills are all of the same type and the Foote-Burt is in measure very similar. Three of these machines are used for drilling, two for reaming and one for finishing the bottom of the hole after drilling and preparatory to reaming. The bottom of the hole after being drilled is, of course, V-shaped, and has to be machined to remove some of the metal so that the reamer can make the finishing cut in the same operation as the inside of the hole is finished.



DRILLING-OUT BAR STOCK.

All the drilling machines are equipped with precisely the same type of vise for holding the bar stock during the operation. The vise is a box-shaped casting fastened to the drill table. It has four jaws, two on each side, which conform to the shape of the bar. The jaws are operated by a spindle, with right-hand threads moving one set of jaws and left-hand taking care of the set on the other side. Thus, when the operator turns the hand wheel on this spindle, the jaws close in on the bar stock, which is held vertically. The bars are 9¾ in. long by 3½ in. diameter, the hole being approximately 1⅞ in. diameter. The bars are first of all drilled, and, to ensure the drill being central at the beginning of the cut, a steel guide collar is placed in the hole in top of the fixture, the collar being removed after the drill has made a fair start. After being drilled, the bar is removed to another drilling machine to have the bottom of the hole roughed out preparatory to reaming. The bar is now reamed out on another drilling machine, this constituting the finishing cut for the hole, with the exception of that part at the nose which is afterwards threaded. A long twist drill is used for drilling and a short reamer with a long shank for the reaming operations. The bars are next gauged for correct depth and diameter of hole, and taken over to the turret lathes for the succeeding operation. Twist drills and reamers, supplied by the John Morrow Screw & Nut Co. are used extensively at this plant for this operation.

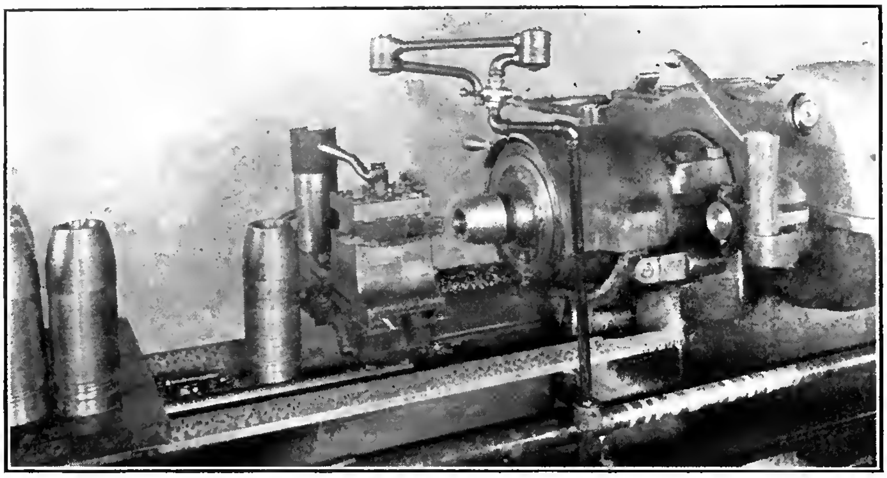


ROUGH TURN BAR, ROUGH TURN RECESS IN BASE, GROOVING, UNDERCUTTING AND WAVING.

Rough Turning Bar, Grooving, Waving, Dovetailing and Recessing Base.

Considerable progress is made in this operation, which consists of rough turning the bar, roughing out

the recess in the base, grooving, forming the wave lines, undercutting and facing up the base. Five turret lathes, furnished by the Warner & Swasey Co., Cleveland, Ohio, are installed for the work. Their tooling was, of course, designed for handling this type of shell. These lathes are equipped with universal chucks, carrying a three-point cam on their face, and have, in addition, an expanding mandrel to ensure that the bar is set in the lathe in alignment with the hole, so that, after machining, the shell may be as concentric as possible. At the extreme end of the mandrel is a projection, behind which is a spring. There are also three stops near the end of the mandrel. When setting the bar in the lathe, it is placed in the chuck over the mandrel and pushed home by a long bar stop on one corner of the turret. This action presses in the projection at end of mandrel, and at the same time forces out the three stops against the inside of the bar, thus setting the bar in alignment and in the correct position, and at the same time helping to hold the bar rigid while being machined. The chuck is then tightened up and the turret advanced towards the work.



ROUGH TURNING SHELL NOSE.

The first turret face holds a fixture with three arms, two having a roller each and the third a cutting tool. The rollers hold the bar steady while a roughing cut is made along the bar. The second turret face holds a fixture with two rollers, similar to No. 1, and has an end mill in the centre. At the side of the mill is a small cutter for roughing the base outside. The rollers hold the bar steady while the end mill roughs out the recess in base. At the same time, the small cutter at the side finishes the base face.

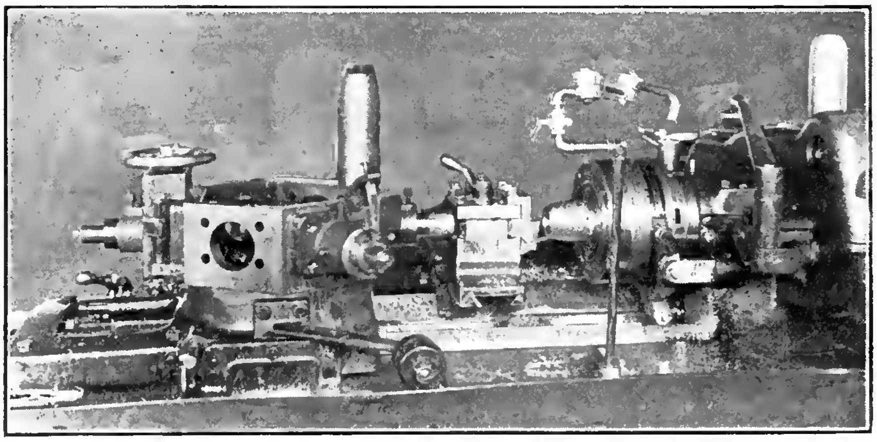
The tool holder on the cross slide, which is fitted up in a very ingenious manner, is now brought into action. On one side of the tool holder is the grooving cutter and a hook-nosed tool for finishing the base. On the reverse side is the waving tool. The tool holder is turned round by the operator as required. Of these two settings, the first mentioned is now brought into operation. The grooving cutter is so made that while forming the groove, the corner of base is rounded off, and at the same time the tool at the side of cutter finishes up the end of base. When grooving, sufficient metal is left to form the wave lines. The tool holder is now swung round for the waving operation. The waving is done by means of a sliding bar in a block held in the tool holder on the cross slide. At one end of this bar is a roller which runs up against the face of the cam fastened to the chuck, this being made so as to generate the required form to the wave. The roller is held up against the face of the cam by a strong spring inserted in the under part of sliding bar. A cutter of suitable shape is held in the sliding bar and is adjustable. In operation, the saddle is moved along until the roller is up against the cam, and then locked. The wave lines are then formed.

The third turret face holds a fixture with a cutter which finishes the base at the side. The fourth turret face holds the dovetailing fixture, which is above the work when in operation. This consists of two small holders working in diagonal slides, each holding a small hook-nose cutter. The turret is moved forward until the cutters are in the desired position over the groove and the operator feeds the cutter in a downward direction by means of a hand wheel. This operation finishes the groove, which is now ready for the copper driving band to be pressed on at a later stage. The feeds for the turret tools are controlled by feed rods at the front of the lathe running from the speed box. All stop motions are controlled from a screw rod located under the turret with a set of stop dogs, one for each turret operation.

Rough Turning Nose.

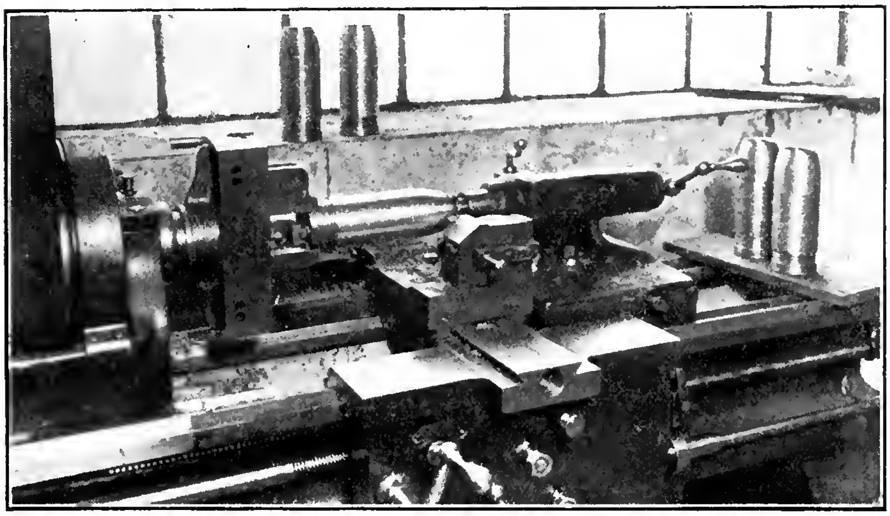
Upon completion of the foregoing operation, the shell nose is rough turned. The end of the bar at this stage is square, no machining having yet been done on it, therefore considerable metal has to be removed before the nose assumes its final shape. To facilitate the work then at a later stage, the nose is now rough-turned or "hogged"—that is, two heavy cuts are taken off so that an ordinary roughing cut only is necessary at the next operation, which simplifies the tooling.

This "hogging" is done on a Warner & Swasey turret lathe, the same type of machine as is used for the previous operation, except that a cam attachment is added and the saddle made to suit. The turret, however, is not used, the work being done by an ordinary turning tool located in the tool holder on the slide rest. In this case, the turret lathe is equipped with a collet chuck operated by a draw-back mechanism. To obtain the profile for the nose, a cam fixture is attached to the bed of the lathe at the front and under the saddle; the latter is specially constructed for the work and overlaps the cam. A roller on the slide rest passes through a slot in the saddle and engages with the cam underneath.



ROUGH TURNING OUTSIDE OF NOSE, REAMING INSIDE OF NOSE, FORMING BEVEL, AND FUSE PLUG SEAT, CUTTING RECESS IN NOSE.

The cut is started at the end of nose and the tool travels inwards, forming the nose to the required profile. Sufficient metal is left to allow for a roughing cut at the next operation. An engine lathe, supplied by Prentice Bros., Worcester, Mass., is also used for "hogging" the nose. In this case the cam is at the back of the lathe fixed to a bracket attached to the bed. A compound slide rest has an extension with a roller engaging with the cam. The lathe is equipped with a standard tool holder and turning tool. The method of procedure is the same as stated above, and the same amount of metal is removed.



FINISH TURNING SHELL BODY OUTSIDE.

Rough Turning Nose, Reaming Nose Inside, Cutting Fuse Plug Seat and Recess in Nose.

Up to this point no work has been done on the inside of the nose since the hole was drilled at the first operation. At this stage the bevel or outside part of fuse plug seat at the nose is formed, and the nose is rough turned outside preparatory to the finishing cut at a later operation. That part of nose which has to be threaded is reamed out and the fuse plug taper seat at nose is formed at the same time. Finally the recess is cut inside nose about 1½ in. from the end. This operation is performed on a Warner & Swasey turret lathe of identically the same type as used in the two preceding operations. The lathe is equipped with a collet chuck operated by a draw-back mechanism.

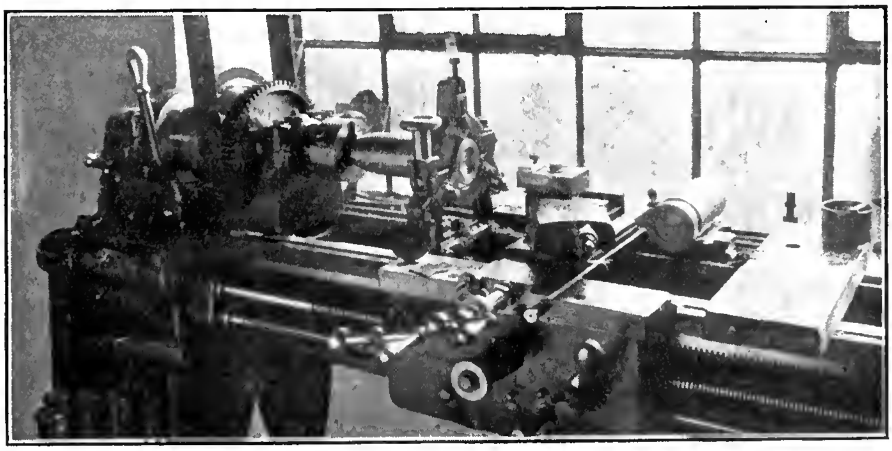
The operator places the shell in the chuck, the correct location being determined by a stop on turret face, the turret being moved up against the shell when setting. On the slide rest is a tool holder, one face holding a cutter for forming the bevel on the outside of the nose. The reverse face of the tool holder has a tool for rough-turning outside of the nose. The first of the above-mentioned tools is now moved towards the work and the bevel on the outside of nose is formed. A bar stop on lathe regulates depth of cut. This bevel forms the outside seat for the fuse plug. The tool holder is next swung round and a roughing cut made on the outside of the nose. To obtain the correct profile for this while being turned, the same cam and saddle arrangement are used as in the previous operation.

The hole inside the nose is now reamed out by a reamer fixed in the second turret face. Above the reamer, held in a fixture, is a tool which finishes the bevel on nose outside. At the same time, a small cutter at the side of the reamer forms the fuse plug taper seat. The turret is then swung round to the third position for cutting the recess in nose, in which the threads finish. The fixture held in the turret face consists of a vertical slide, on which is a bar with a small cutter at the end, and on the bar is a collar for giving the correct location for the recess. The turret is moved forward until the collar is up against the nose. The cutter being now in position, the operator turns a hand-wheel above the fixture, and the cutter forms the recess, a stop on the fixture regulating the depth of cut.

Finish Turning Outside Shell.

The next operation consists of finishing the outside of the shell from the groove to the bevel at the end of nose. It will be remembered that the side of shell between the groove and base has already been finished. Two engine lathes, built by F. E. Reed & Co., Worcester, Mass., are installed for this operation. The base of the shell at the back of groove is held in a chuck with two jaws, leaving the rest of the shell clear to be machined. The correct distance is obtained by means of a stop located between the jaws. At the tail-stock end the shell revolves on an expanding centre specially designed for this work. The outside of this centre is a sliding fit in the nose of shell, and the inside is tapered to suit the tail-stock centre. The centre, being of the expanding type, tightens up when pressed in.

The profile on the nose of shell is obtained by means of a cam fastened to a bracket at the back of the lathe and attached to the bed. On the saddle is a specially designed cross slide, the front part of which extends over the cam, and has a roller underneath for engaging with the cam. The tool holder is a special device, part of it being solid with the cross slide. It holds a vertical turning tool, and has a regulating screw for making adjustments to the tool. The cut is started at the base and finished at the nose, approximately 1/32 in. being removed. When the cut is completed, a stop on the feed screw is tripped and the feed stopped. A feature of this machine is that the saddle only is moved to place the tool in position to start the cut. The cross slide is not moved in and out, as is usually the case.

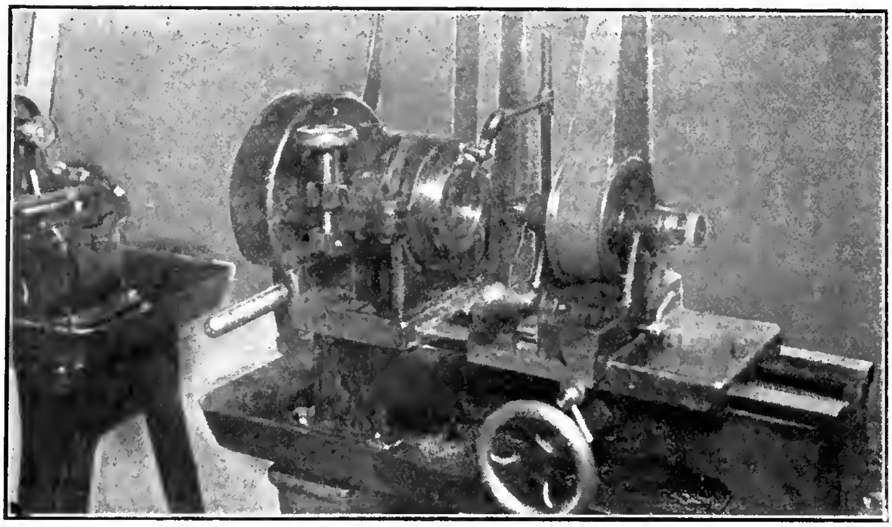


FINISH TURNING RECESS IN BASE.

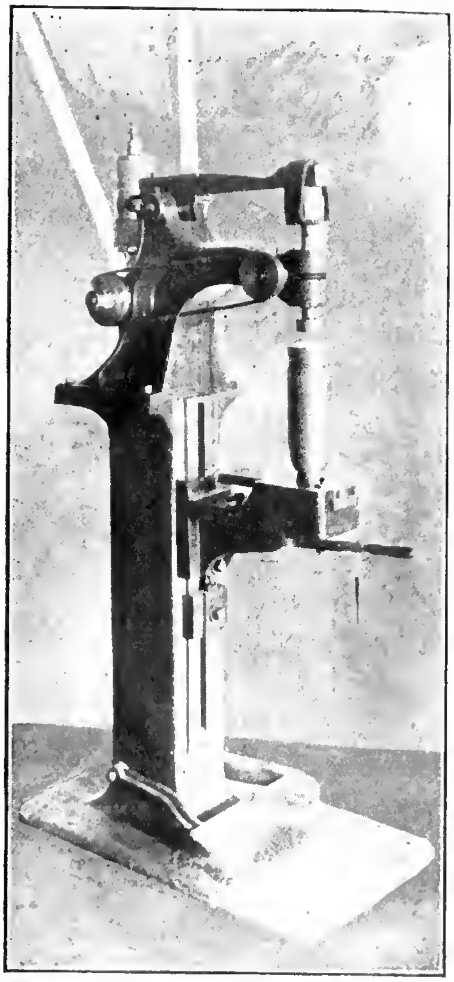
Finishing Base.

At the next operation the base is finished and prepared for threading. Two

engine lathes are installed for this work, supplied by the R. K. Le Blond Machine Tool Co. and by the Fay & Scott Co. The shell is held in a universal chuck, the jaws gripping inside the nose, while at the base end is a steady rest. The base counterbore is prepared for the threads at the next operation and the bottom of base is finished.



MILLER FOR THREADING BASE RECESS, AND FOR THREADING AND FORMING RECESS IN NOSE.



PEINING HAMMER FOR BASE PLUG.

Milling Threads in Nose and Base, Cutting Recess in Base.

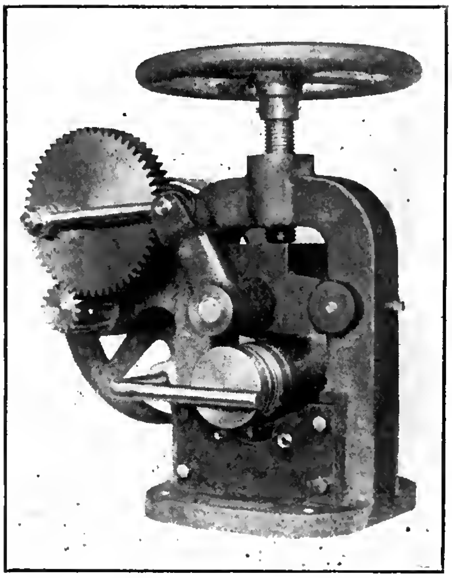
These three operations are distinct, but are performed on the same type of machine. The method of procedure is so very similar in all cases that with few exceptions one description will cover all three. The practice followed at this plant consists of milling the threads, a method which seems well adapted for this particular class of work. The machines installed for this operation were designed and built by the Holden-Morgan Co., Ltd., Toronto, and specially for working on high explosive shells. Results show an accurate and clean thread, with the elimination of the possibility of stripping same. The illustration gives a general idea of the machine and a description covering the threading of the hose will serve to explain roughly the construction and operation of the machine as well.

The casing on the left contains a hollow revolving spindle for holding the shell, while the inside end of spindle is cone-shaped to take the nose. The spindle is thus self-centering. At the end on the left is a worm wheel for revolving the spindle, this being operated by a worm shown below. At the end of the worm, at the back, is a pulley driven from the shafting above. The outside of the spindle is threaded at the centre, and the clamp shown there is closed over the thread when the spindle is required to travel horizontally. At the extreme left and outside of the casting and forming part of the spindle is a flange for operating an automatic stop motion. There is also at the same point a lever for throwing the stop out by hand, if necessary.

The shell is placed in the spindle from the left-hand side, nose first, and a lock-nut with right-hand threads is screwed in the end of the spindle to hold shell firm inside. The milling cutter at the end of the spindle carrying the pulley is inserted in the nose as far as the recess. The pulley bracket is attached to the cross slide on the saddle, which is operated by the hand wheel at the front. When the cutter is inside the nose, the operator, by means of the small lever in front, moves the cross slide up to a graduated stop at the back and locks it. This gives the required depth of cut for the threads. The spindle containing the shell now begins to revolve slowly and at the same time travel in a horizontal direction outwards and thus away from the cutter, which has no lateral motion. The spindle makes one revolution, at the end of which the flange on the outside throws out the automatic stop. The threads are now cut and the shell removed.

When cutting the recess in the base, which is the next operation, the shell is put into the hollow spindle, base end first, and tightened up. As the spindle in this case must not travel, but only revolve, the clamp is removed so that the threads have nothing to work against. A stop is placed in position to prevent the spindle making any lateral motion. Two thin cutters are mounted on the spindle the required distance apart and the spindle inserted in the base. The operation of the slide rest is the same as described above. The spindle makes one revolution as before, and both recesses are cut at one time.

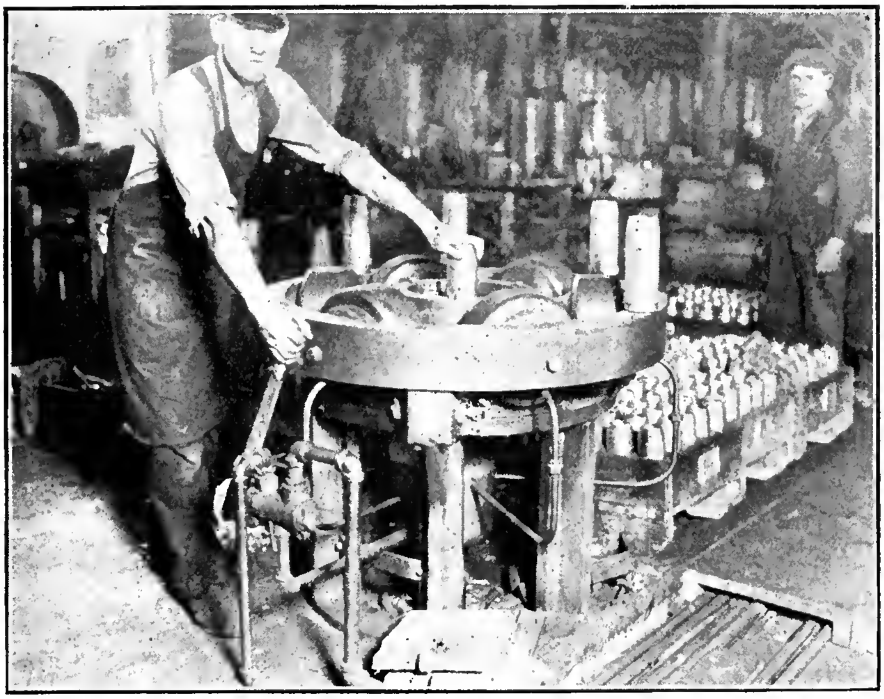
For threading the base, the shell is re-



HOLDEN-MORGAN SHELL MARKING MACHINE.

moved to another machine of the same type, the operation in this case being practically the same as for threading the nose. The principal exceptions are the lock-nut, which has a left-hand thread and the cutter, which is, of course, somewhat narrower. The threads in the base are left-hand, and the machine

operates in the opposite direction to the nose-threading machine. This is taken care of by crossing the belts.



GOLDIE & McCULLOCH BANDING PRESS IN OPERATION.

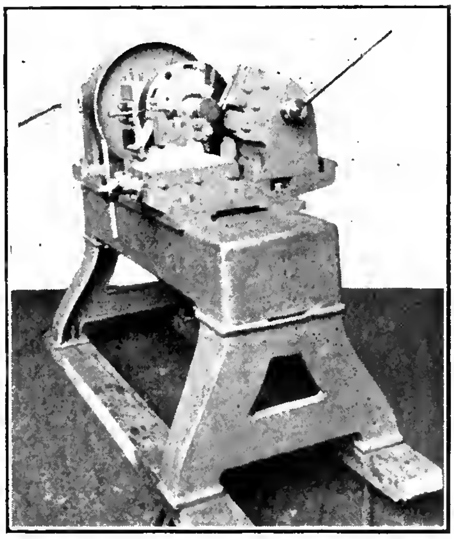
Marking.

The markings are put on the shell by a machine built for this purpose by the Holden-Morgan Co., Toronto. As will be seen from the illustration, the shell is laid on two rollers horizontally against a stop. The operator by turning the hand wheel forces down a round steel die, on which the markings are embossed, on to the shell. The die is oscillated by means of the crank, and has a travel of about 1½ ins., which takes care of the curvature of the shell. The rollers on which the shell rests allow it to oscillate with the die. The machine is continuous running, and rests on a bench when in operation. The markings are the same as for the shrapnel shell, with the exception of mark II. instead of mark III.

Machining Base Plug.

The base plug is a steel forging and, of course, has to be machined and threaded to fit the base. An engine lathe, furnished by the American Tool Works Co., Cincinnati, Ohio, is installed for this purpose. The principal feature about this machine is the construction of the saddle and fixtures mounted thereon. A tool holder with three tools is mounted on the saddle in front, on the cross slide. The square end of plug is held in an expanding chuck tightened up by means of a draw-back mechanism in the headstock. The tools mentioned above rough turn the side of plug, form the camber on the face, and round off the corner in the order mentioned. At the back is a block holding a tool, which finish turns the side of plug.

For cutting the threads on the plug, there is fastened to the saddle at the back a bracket holding a swinging arm. This arm holds a milling cutter operated through a chain drive from a belt-driven pulley on a similar bracket, also at the back. The arm is brought forward and the end clamped to a block on the front of the saddle. The plug revolves slowly, and the cutter, also revolving, cuts the threads, which are left-hand. This firm is developing a special tool for machining and milling the base plug at one chucking.

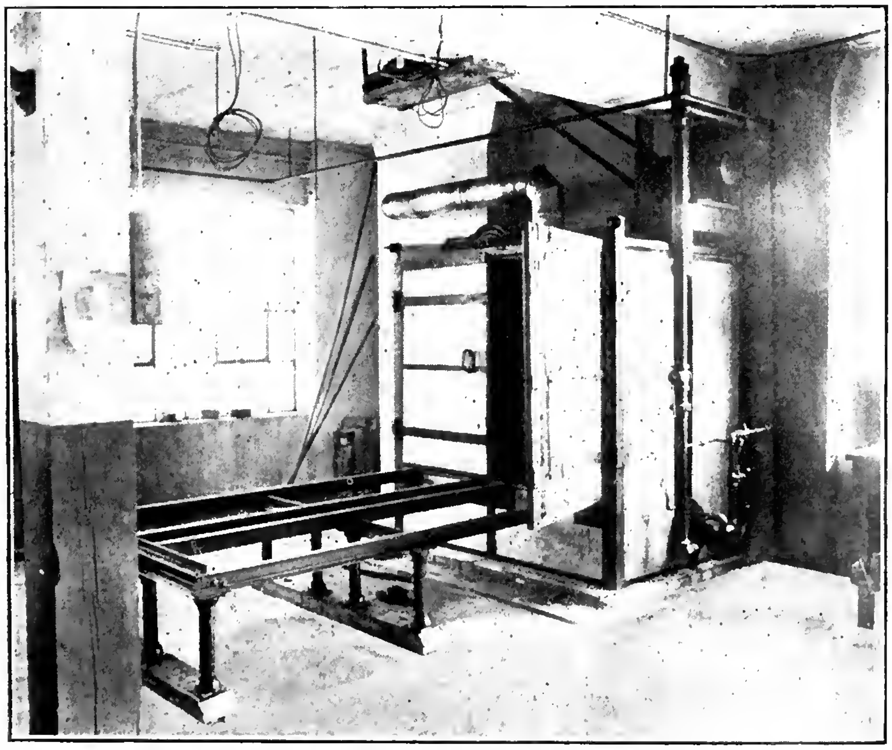


JENCKES MACHINE CO. BAND TURNING LATHE.

Grub Screw Hole and Inspection.

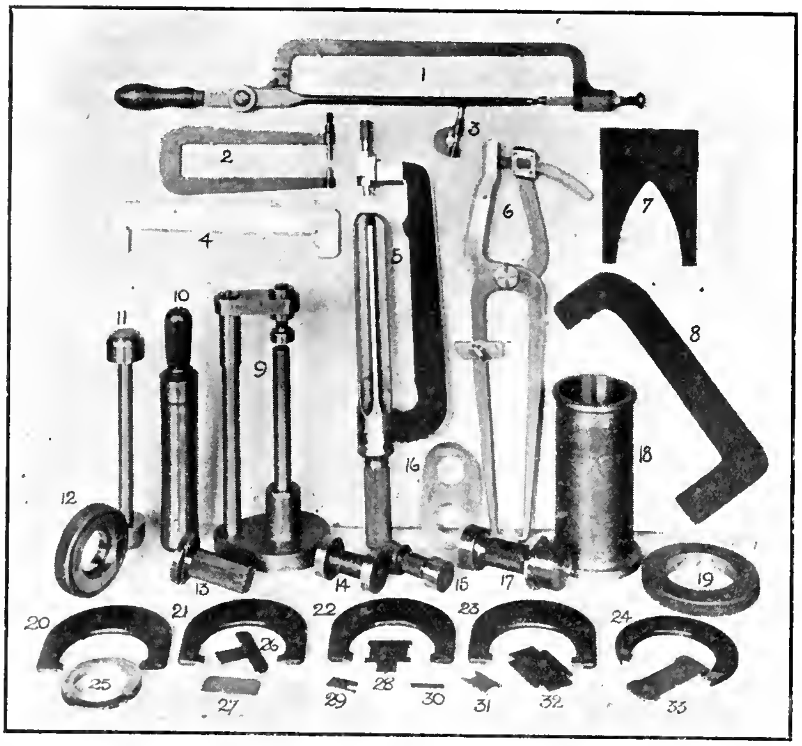
The hole is now drilled and tapped for the grub screw in the nose. The grub screw purpose is to secure the fuse plug. Three high-speed, single spindle, drill presses, supplied by the W. F. & John Barnes Co., Rockford, Ill., are installed for this operation, one drill being equipped with a tapping attachment for threading the hole.

The shells are at this stage gauged and examined by a Government inspector previous to the base plug being screwed in. Before being examined, however, they are taken to a power press to have a series of notches stamped in



EXTERIOR VIEW OF VARNISH BAKING OVEN.

the wave lines. This is an extra safeguard against any possibility of the copper band moving round when the shell is being discharged from the gun.



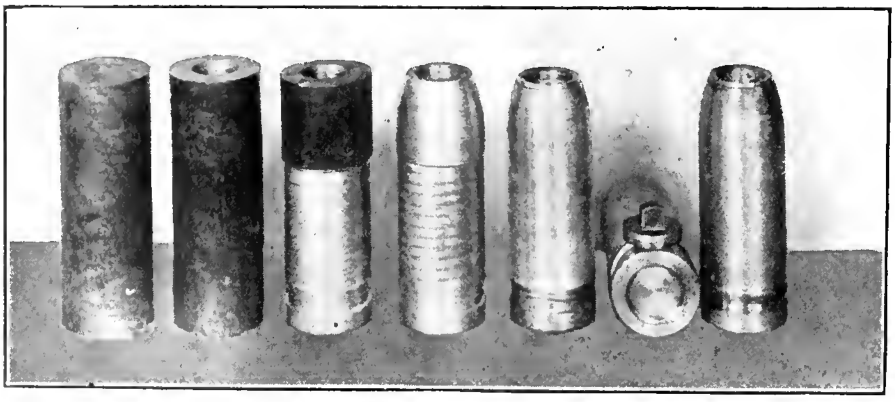
GAUGES, ETC., USED IN H. E. SHELL MANUFACTURE.

1.—Base Thickness Caliper (British). 2.—Thickuess of Wall. 3.—Thickness of Wall at Nose Bevel. 4.—Finished Length Overall. 5.—Base Thickness Caliper (Holden-Morgan). 6.—Wall. 7.—Profile of Head. 8.—Finish Length Overall. 9.—Base Thickness Caliper (Shell Committee). 10.—Concentricity and Low Diameter Gauge . 11. H. and L. Radius at Bottom Inside. 12.—Female Base Plug Threads. 13.—Male Base Plug Threads. 14.—H. and L. Nose Before Threading. 15 and 16.—Plug Gauges for Cartridge Case Ends. 17.—H. and L. Nose Screw Plug Gauge and Angle of Seat. 16.—Cylinder Gauge for Outside Diameter and Concentricity of Driving Band. 19.—Diameter of Body. 20, 21, 22 and 23.—H. and L. Gauges for Body and Driving Band Groove. 24.—H. and L. Diameter at Base Gauge for Cartridge Case Seat. 25.—H. and L. Depth of Recess In Nose. 26.—Recess in Nose. 27.—Form of Driving Band. 28.—Width of Driving Band and Distance up from Base. 29.—Distance of Fixing Screw from End of Nose. 30.—Undercut in Driving Band Groove. 31.—Width of Driving Band. 32.—Flatness of Depth of Base Plug Recess. 33.—Bevel on Nose of Shell.

Fitting Plug in Base.

The next stage involves practically four operations, which may be classified as follows: Screwing in base plug, cutting square end off plug. Care has to be exercised in screwing in the plug, as it must come up against the inside of base and be a tight fit. A vertical hydraulic press is installed, which was built by Perrin & Co., Toronto. The shell is held in a horizontal direction in the press by means of a clamp fixture located above the ram. In direct line with the centre of the clamp is a bracket for holding a bar, one end of which has a socket for holding the end of plug, while at the outside end is fixed a ratchet for the base. The plug before being screwed in is covered with a mixture of tar, shellac and rubber cement. The shell is next moved to a "Racine" power hack saw to have the square end of plug cut off, after which the joint between plug and base is hammered.

For this operation a high-speed hammer is installed, being built by the High-Speed Hammer Co., Rochester, N.Y. The illustration shows the principal features of this hammer, and method of operation will be readily understood. The shell is placed over a vertical spindle on the table slide, and is a sliding fit, the slide having first been drawn out to allow for this. This slide is then pushed back and locked, the shell being placed under the hammer, which is operated by a friction pulley and controlled by the operator by means of a foot lever. The hammer head is circular and about the same diameter as the plug. On the face of the hammer head are two small projections or lugs which strike on the joint between the plug and base, thus closing it up. While in operation, the hammer spindle is revolved by means of a worm and wheel device on the head driven by a pulley from the back shaft, thus distributing the blows evenly. The blows of the hammer are of an elastic character, which is obtained by two rubber bumpers in the rear of the machine and a bumper between hammer head and helve. The hickory helve absorbs the shock of the rebound. The base is now turned upon an ordinary engine lathe, which finishes that part of the shell.



VARIOUS STAGES OF MANUFACTURE FROM BAR STOCK TO FINISHED SHELL CASE.

Copper Band Press.

The shells have the copper band pressed on next, and for this purpose are taken to a hydraulic banding press which was built by the Goldie & McCulloch Co., Galt, Ont. The press which is operated by a hydraulic pump, has six horizontal rams 8 in. diameter converging towards the centre and their dies running in guides. The copper band is slipped over the end of the shell into the groove and secured in place with the assistance of a hand hammer. The operator places the shell base down on the plate in the centre and applies the pressure by means of a lever. The six jaws converging closely press the copper band, completely filling the groove and the undercut. The jaws are then released and the shell turned slightly, after which the pressure is again applied thus equalizing same all round the band.

Copper Band Turning.

The next operation consists of turning the copper band. This is performed on a machine built by the Jenckes Machine Co., Sherbrooke, Que., and was specially designed for this class of work. On the headstock spindle is mounted a clutch pulley, the clutch being operated by a lever within reach of the operator. A universal chuck is attached to the spindle and a tool-slide base is clamped to the lathe bed. The shell is placed in the chuck and is located in the correct position by a swinging finger on the front tool block before the chuck is tightened.

The front or roughing tool is held in a fixture working on a cross-slide on the fixed saddle. The tool is fed in by a screw and hand wheel to a dead stop. The front tool holder is also provided with a hinged scraper rest for removing

the ragged edge at each side of band after tooling.

The rear or finishing tool is held in a steel block working in a slide on a fixture on the saddle at the back. The tool is mounted above the work but can be adjusted to pass down behind the shells, and, in passing, shave the band to size. The feed is by lever and pinion.

Varnishing.

The shells are now washed in a tank containing hot soda water to remove the oil, etc, the soda water being heated by means of gas burners located under the tank. The shells dry quickly and are then taken to the varnishing department. The "copal" varnish used is a special preparation for coating the inside of the shell to prevent the explosive from corroding the metal and so weakening the walls of the shell. Lyddite has this peculiar characteristic which of course has to be guarded against. A hollow brass plug is first screwed into the nose to prevent the varnish from touching the threads. The shell is then filled with varnish by means of a "Bowser" self measuring storage tank equipped with a hand pump. The varnish is afterwards poured back into the tank and the shells are placed on a draining rack, nose down, where they remain for an hour or so. The draining rack consists of a wooden framework with a number of sections each large enough for one shell. The shells rest on strong steel netting, under which is a tray for catching the varnish drainings.

Baking.

In order to thoroughly dry the varnish, it is necessary to heat the shells in an oven for a certain length of time at a suitable temperature. This process is known as "baking," and it is done in a "Crawford" sectional gas heated oven supplied by the Oven Equipment & Mfg. Co., New Haven, Conn. The accompanying illustration shows the oven exterior and tracks, but the trucks which are used in connection with it were unavoidably omitted from the photograph. The outside of the oven is constructed of galvanized sheets and the inside of black sheets with insulating material between them to prevent radiation of heat. The doors are also insulated and are a tight fit when closed.

In the bottom section of the oven is a steel cylinder with six pipes on each side, each having a burner at the end, operating on the "Bunsen" principle. In connection with the gas pipes there is also an air pipe conveying air to the burners from the motor driven blower on the top of the oven. The pipe outside on the left is the air pipe with a pressure gauge, and in the middle is the gas pipe connecting to the cylinder head outside of the oven. A thermometer at the side near the top indicates the temperature inside. The shells are baked for eight hours at a temperature of 300 degrees F.

To facilitate the handling of the shells from the draining table to the oven, an overhead runway system is installed. The shells are placed in boxes, partitioned off to hold a batch of 120, and these boxes are slung from the runway, moved along to the oven and deposited on the trucks outside on the tracks. When a sufficient number of boxes have been placed on the trucks they are moved into the oven, the tracks of course extending inside.

Painting and Inspection.

After the baking process has been completed, the hollow brass plugs are removed from the nose and a solid brass plug screwed in. The shells are then carefully examined, weighed and gauged all over by a Government inspector, who selects one from each series of 120 for the firing test. The rest are sent forward to the painting department for the final operation. The painting machine is a portable outfit, and consists of a table with a cup-shaped revolving holder driven by a small electric motor. The shells are placed in the holder and painted while revolving. The priming coat is white and the second coat yellow ochre.

Gauging.

Gauging plays a very important part in making shells, as the greatest accuracy has to be obtained in order that the weight of the shell when completed shall be exact to within very fine limits. This precision can only be secured by the exercise of the greatest care at each operation involving the removal of metal. High and low limit gauges are used throughout, and the shells are gauged after each machining operation. In addition, the shells are gauged and examined twice by specially appointed inspectors, as already stated in this article. The accompanying illustration shows a number of typical gauges used ing the work, all being made by the Holden-Morgan Co. The final weight of shell casing is just under 15 pounds, and 1 oz. only is allowed for come-and-go.

For handling the shells between the various operations, "Chapman" transveying and elevating trucks are used. The shells are stored in wooden racks, each holding a series of 120, and these racks are moved around by means of the truck.

Port Arthur, Ont. — The Board of Trade is organizing local manufacturers in an effort to obtain orders for military equipment.

CAST IRON vs. STEEL SHELLS.

THE fact that fragments of presumably cast iron shell cases have recently been picked up on the battlefields in Flanders has had the natural result of raising the question as to why, if the Germans employ this material, then shouldn't we? The subject has been aired in the British House of Commons, and has formed the theme of more or less correspondence in the editorial columns of both the lay and technical press. Our contemporary, "The Engineer," has very opportunely investigated the matter, and additional point is given to its editorial pronouncement from the fact that it had for inspection a piece of a German cast iron projectile, received from a correspondent.

Referring, in the first instance, to the sample submitted, which was about 2 inches square and ¾-inch thick, the opinion is expressed that it belonged to a 6-inch diameter shell, that the internal surface had been cast on a chill, and that while the outside surface had been turned, the inside had not been so treated. The observations made and deductions drawn, which follow, will be found highly interesting and instructive as well.

Objections.

"There are several objections to such shells. In the first place, where shrapnel is concerned, the number of bullets is reduced because the walls of the projectile must be made much thicker. In the case of high-explosive shell, this does not apply in so great a degree, because the walls of the steel shell are then made thicker than is necessary for strength, but there is such danger of a cast iron shell developing cracks during manufacture that high explosives cannot safely be used in them. It must be remembered that no risk of a shell bursting in a gun must be run, and no one will doubt that there is more risk in cast iron than there is in forged steel.

"Another point against cast iron is connected with accuracy of fire. To ensure this, the projectile must be perfectly in balance. The walls must not only be of exactly the same thickness all round, but they must be homogeneous. At the very high speed of revolution set up by the rifling, a small difference of weight to one side of the centre line would be quite sufficient to cause irregular shooting. With forged steel there is little or no difficulty in securing this balance; with cast iron there is always some danger of local porosity, which, besides being a source of weakness, would destroy accuracy.

"Moreover, if the projectile were cast on a chill core and was not machined internally a risk of the core not being absolutely concentric would always have to

be faced. Accurate fire would then be impossible. To remove a chill core, even if it were collapsible, it would be necessary to have a large hole in the base of a high explosive shell, of which the point is always solid, which subsequently would have to be plugged. If a sand core were used it might be removed through a smaller hole, but the machining of the interior would be difficult owing to the shape of the ogival head and the smallness of the hole through which the tool must be entered. In the case of shrapnel the boring would be much easier, because a large opening is left for filling purposes, but, owing to the small number of bullets that could be carried, cast iron shrapnel cannot be considered.

"All these facts have militated against cast iron shell, and although, of course, cast iron and cast steel were used at one time they have entirely given place to forged steel. Furthermore the methods of manufacture of steel shell have been so developed that such shell can actually be turned out more quickly than those of cast iron of equal reliability and accuracy. An 18-pounder shell for example, can be completely machined from the bar in about forty minutes. The case for the forged steel shell is, then, complete, and there is no case at all for the cast iron shell.

A Case of Necessity.

"The answer is fairly obvious, as to why Germans are using cast iron shells. In spite of the greatness of the supplies of their modern guns and projectiles, the Germans are beginning to find them not inexhaustible under the tremendous drain that is being put upon them. Hence, guns and projectiles have been drawn from stores many years' old to fill up the deficit in modern supplies. The guns use a lower powder pressure, which the cast iron is able to stand, and the shells are probably filled with black powder, so that less danger is to be feared from an accidental burst. We believe this to be the real reason for the fragment of a cast iron shell being found on the battlefield.

"Whether the Allies also are using old guns and shell we cannot say, but it is not inherently improbable. Every nation concerned has been surprised by the part artillery has been called upon to play, and it is not unlikely that all of them have drawn upon resources of every kind that can be turned to account. If the Germans are indeed using cast iron, it is a favorable sign, for it shows that even they, with all their preparation, were unable to collect enough material of a modern kind to meet the requirements of the war.

There are, of course, not wanting those who, while agreeing that for accurate fire or penetration the cast iron shell is non-serviceable, still believe that for scattering earthworks and breaking down wire entanglements, chunks of cast iron are just as effective as chunks of steel, and, of course, cost much less.

A RESULT OF SHELL-MAKING IN CANADA.

APART from the immediate benefits accruing, the growth of the shell business is regarded by many business men as one of the most important developments of its kind that has yet taken place in industrial Canada. Their view is this—that it has shaken a big industry, steel and its allied branches, out of a rut; stimulated inventive qualities in the mills and compelled the development of adaptability to changing conditions.

When the shell business ceases with the end of the war, it is argued that manufacturers will be less ready to throw up their hands, because business along the old lines had ceased, as they did in many cases last summer, and will be alert for new opportunities. The high praise that has been bestowed on the Canadian shell makers by the Imperial Government is proof that adaptability and efficiency of a high order existed, but that initiative was to some extent lacking.

GIVING EXPRESSION TO OUR POTENTIALITY.

The present era in Canada will loom large in the annals of history, not alone because of the part we are taking in fighting for the Empire, but also for the industrial manhood that has been awakened within us. This does not necessarily mean that we are accomplishing great things from a manufacturing viewpoint, but it does mean that day by day we are fast learning, and not without a certain national sense of pride, that we possess a resourcefulness that we knew not of, also adaptive faculties that have been lying dormant and which needed but the inspiration such as present conditions have given us, to awaken our industrial faculties to the point of hitherto non-existent proportions.

AETNA EXPLOSIVES.

ALMOST coincident with the New York report that the Canadian Car & Foundry Co. had placed an order with the Aetna Explosives Co. amounting to about $6,000,000, comes the announcement from Sydney, C.B., that the explosives company was planning to establish a new industry at that place. The details are to the effect that the project has just been organized in New York, and that letters patent have been granted at Ottawa.

This is just another instance of the widespread effect of the shell-making industry in Canada, and there would appear to be every reason to expect that it would be good business for the Aetna Co., after getting an order amounting to $6,000,000, to establish a plant at a point where the business could be expeditiously handled. If Canadian Car & Foundry Co. is going to load shells at Sydney, it would certainly be reasonable that the explosives be made close at hand.

HABIT.

SOURCE of about three-quarters of all human actions, time saver and thought saver, best of slaves and worst of masters—that is Habit. The strength of it is beyond the realization of the people who are the most dependent upon it, and its danger is as great as its value, according to the character of the habits themselves.

A reflective friend of ours has occasion to pass through a certain street every evening at seven o'clock. He says that every night he meets the same people, four or five of them, doing the regular things, so that he looks forward to seeing them, and he is never disappointed.

There is a man who always runs for the seven o'clock car, when he might as easily catch it if he changed his habit of leaving at the last minute to one of leaving the moment before. Then there is the man who drops in regularly at the corner saloon, not because he particularly needs a drink, but because he has done it regularly for some time, and it's easier to do it than stop it. Again, there is a family at dinner he sees as he passes, and the boss is always in his shirt-sleeves, although it is no longer hot weather. You see, he is simply dining with his wife, and he has the habit of doing it this way, and she never gets used to it. She knows better, however, than to try to change his lordship.

Those are some of the habits our reflective friend runs into as he walks through the street nightly. It leads him to make up his mind that if habits are so infernally powerful, how much easier life is to a man who forms them along the right lines. "For," says our friend, "you might as well get the habit of doing it right as of doing it wrong—it's exactly as easy once you get it going. It pays—it's good business, and the habits of punctuality, neatness, courtesy, patience, and a hundred or so more, are so important to life that men call them virtues. However, they are habits, just the same."—Drill Chips.

From Hoisting Engine Manufacture to Lyddite Shells

By F. S. Keith, B.A., Sc.

To take an engineering establishment making a specialty of hoisting engines and convert it into a shell-producing plant in a few weeks with little extra equipment may not warrant a distinguished service medal. It does show, however, that resourcefulness and inventive faculties are being displayed and exercised at this time in a manner which is full of promise for our still greater industrial progress and achievement in the mechanical arts and crafts.

TYPICAL of our machine shops that have changed over to the production of lyddite shells from that of a regular line, is the hoisting engine manufacturing plant here described, and, needless to say, considerable mechanical ingenuity and inventiveness has been displayed in adapting the available machine tool equipment to its new purpose.

Lyddite Shells Less Difficult.

Since the work involved in turning out a lyddite shell involves fewer operations and requires less extra apparatus and detail than is necessary in making shrapnel shells, it seems reasonable to expect that the production of these in Canada should obtain large proportions. In fact, the Shell Committee's specifications for turning out lyddite shells from a solid steel billet is a straight machine shop proposition, except the interior varnishing, baking same and painting, and opens up a wide field for machine shops not now engaged along that line.

Coincident with a description of the various operations necessary to turning out an 18-pdr. lyddite shell, the article will describe the methods adopted in this particular shop to make the greatest possible use of the tools on hand.

Process of Manufacture.

To commence with, the billets intended for lyddite shells are solid steel cylinders, 9¾ inches long by 3½ inches in diameter and weighing 27 pounds each.

The first operation consists in boring ou the billets. This is done on two ordinary drill presses, Fig. 1, Plate I. In the first press, after locating the billet in a jig on the platform, a cap-jig is placed over the top and a small hole drilled about three-quarters of its length. The billet is then placed in the larger drill and a 1¾-in. hole drilled to the same depth as the other. To make this possible on the larger drill, it was necessary to cut three extra slots in the rack to give the proper amount of clearance. The cap-jig used on the first drill was made by Marsh & Henthorn, Belleville, Ont.

Out of the Scrap Heap.

The second operation in the production of the shell consists in nosing and rough-shaping the outside. Ordinarily this is done in a lathe, but by exercising his inventive faculties the superintendent requisitioned an old drill that had long been out of use and converted it into a miller. By this means the work is done much more rapidly than is possible on a lathe, and by using a special tool, which was also manufactured by Marsh & Henthorn, an inexperienced apprentice can operate this machine quickly and effectively. The milling head for this is shown in the illustration on next page. The cutter is arranged so as to take care of the curvature and shape desired. Through the centre of

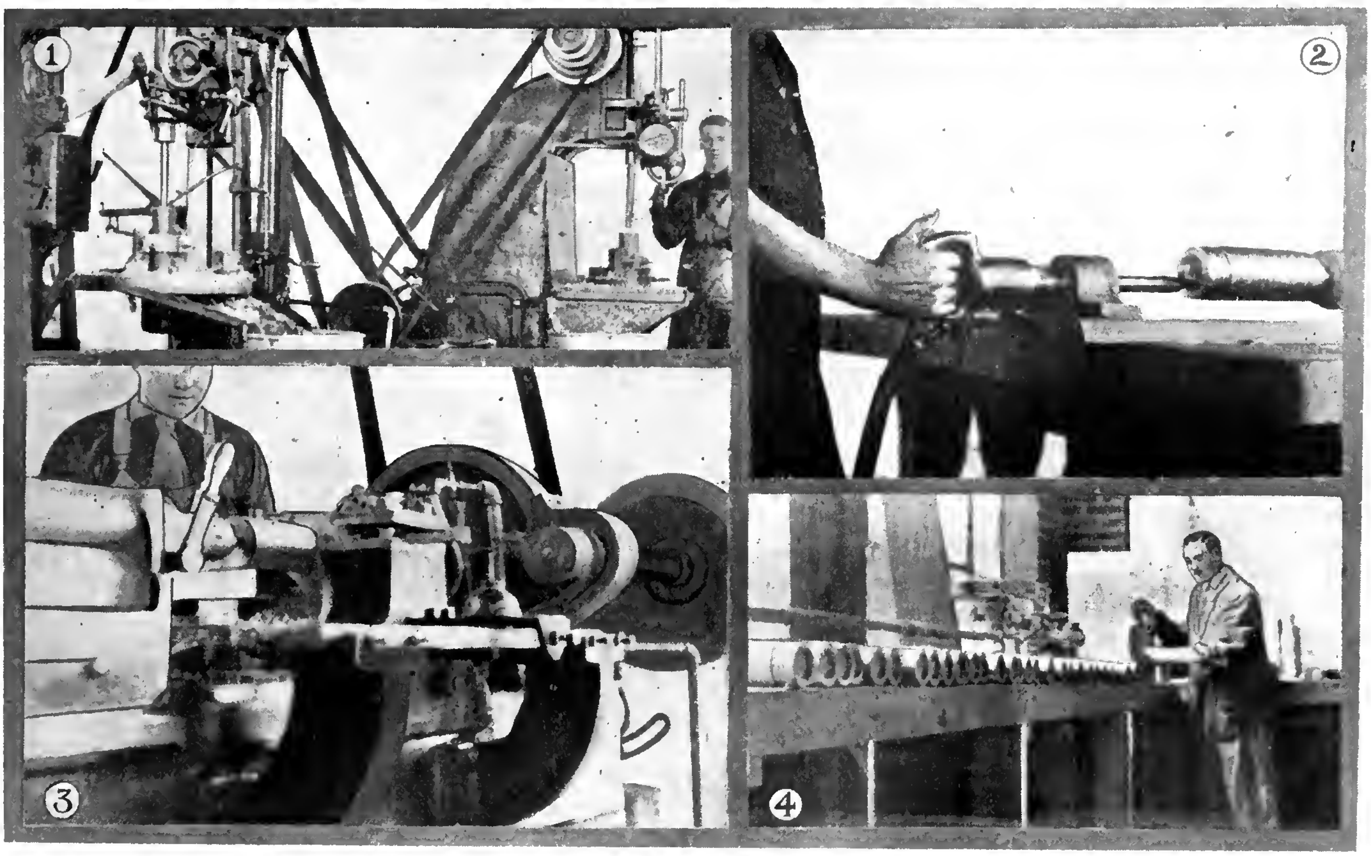


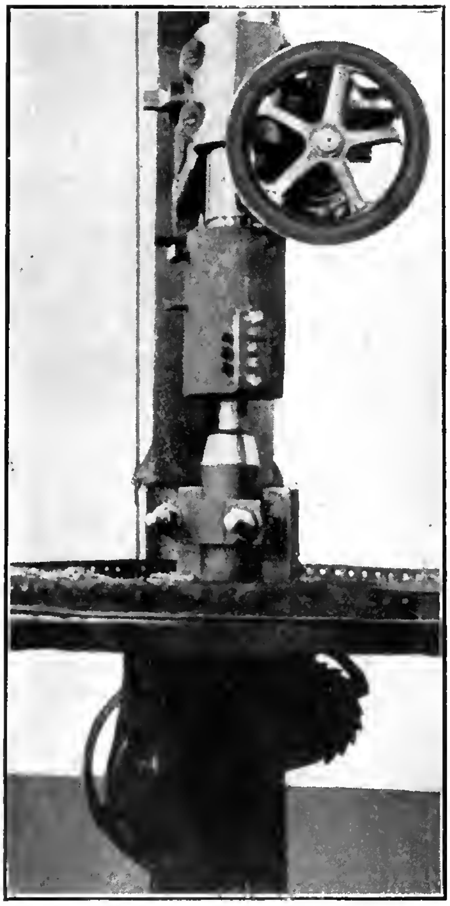
PLATE I.—(1)—BORING OUT BILLETS ON DRILL PRESSES. (2)—PEINING PLUG IN BASE OF SHELL WITH PNEUMATIC HAMMER. (3)—FINISHING SHELL BODY OUTSIDE AND ROUGHING OUT BAND GROOVE. (4)—GOVERNMENT INSPECTION DEPARTMENT.

this cutting head is a spindle which fits the already bored hole in the billet, so that any eccentricity occasioned by the drilling is eliminated.

This method was adopted owing to the scarcity of lathes, and it has proven most efficient. When the shell leaves this machine it has been nosed and is faced to the right length.

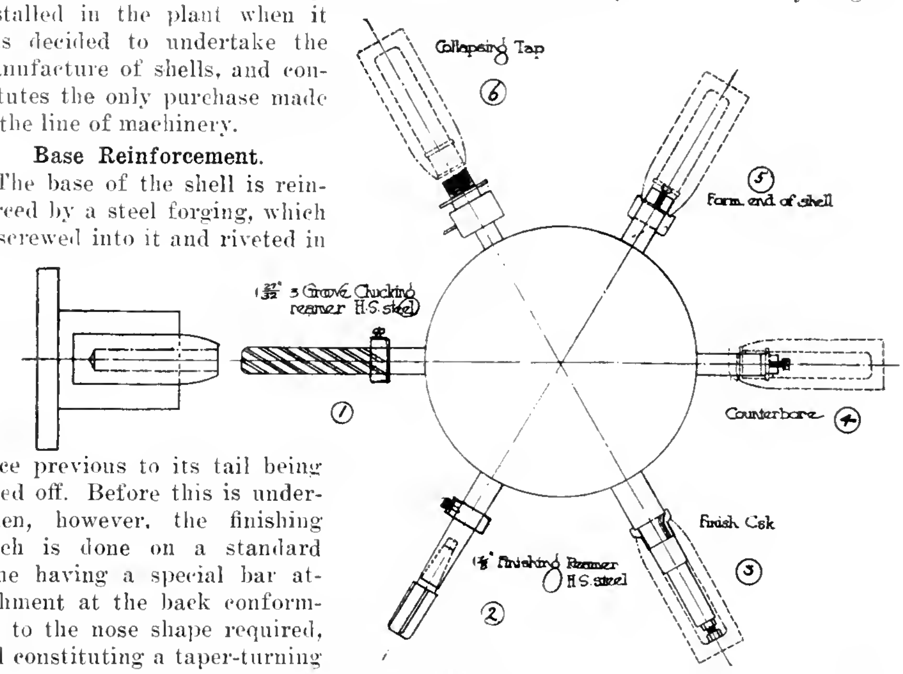
The next operation is that of centering the base, which is done on a special apparatus fitted up on the bed of a nearby engine lathe. This would ordinarily be done on a drill, but by adopting this method it saves keeping a small drill employed for the purpose.

From the centering machine the shell blank is taken to a standard lathe, where it is rough-turned, a forming bar attachment at the back giving the blank the nose shape required. The shell is held at the face plate end in a special three-jaw expanding chuck, and at the other end by the centre on the tailstock.



HEAVY DRILL WITH MILLING ATTACHMENT FOR FORMING SHELL NOSE.

The next move in the process of turning out the completed shell is through a Jones & Lamson lathe fitted with a six-tool turret, as shown in the diagram, above. Here the shell is placed in a special chuck. The first tool is run down, leaving 1/32 of an inch for the finishing reamer number two. Number three tool counterbores the end for the tap and also countersinks the end, while by means of the sliding head on the lathe, number four tool forms the recess at the bottom of the hole for the thread, and number five tool forms the bevel at the outside of the end of the nose. Tool number six taps the thread with a collapsible tap. These six operations absolutely finish the inside machining of the shell. This lathe was the only one not installed in the plant when it was decided to undertake the manufacture of shells, and constitutes the only purchase made in the line of machinery.



TOOLING, JONES & LAMSON TURRET LATHE.

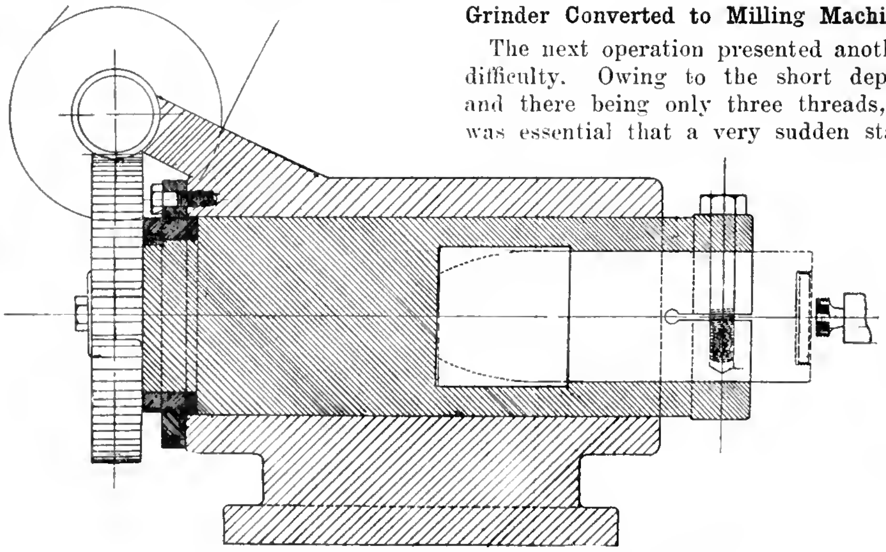
Base Reinforcement.

The base of the shell is reinforced by a steel forging, which is screwed into it and riveted in place previous to its tail being faced off. Before this is undertaken, however, the finishing touch is done on a standard lathe having a special bar attachment at the back conforming to the nose shape required, and constituting a taper-turning attachment. One of the illustrations show this lathe in operation. The wave groove is also made at this time.

To accomplish the reinforcing of the base, a few problems were met with, owing to the lack of another turret lathe, but most of them were overcome in a simple manner. A turret attachment was secured and incorporated on a London Machine Tool Co. lathe. This turret has one tool for boring the recess in the base of the shell, and another for reaming it to size before threading. Owing to the shallow depth of this hole, and the fact that a thread had to be made which was to have a clearance at the bottom, it was necessary to recess the base of this hole. Ordinarily this might have been accomplished by means of a sliding head on the turret, but not having such available, the superintendent invented a special tool which does the work admirably. It is shown by diagram and also in Fig. 3, Plate II., the operator being about to bring the recessing tool into action. This tool is so designed that when set by the operator against an adjustable stop, the correct depth and width of undercut are automatically obtained.

Grinder Converted to Milling Machine.

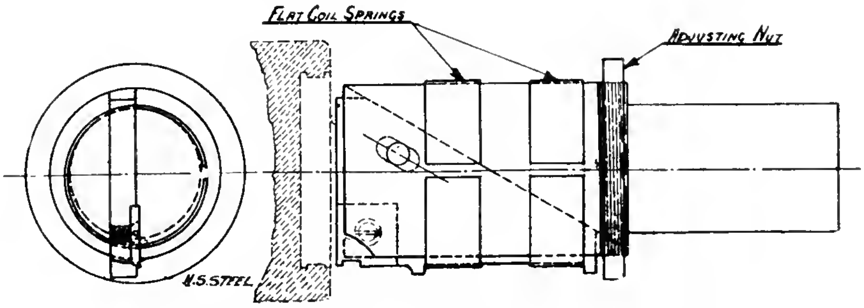
The next operation presented another difficulty. Owing to the short depth, and there being only three threads, it was essential that a very sudden start be made with the thread. This is somewhat difficult to do with a tap; a milling arrangement was, therefore, designed to take care of the threading. Fig. 1, Plate II., indicates just how this was accomplished. As it shows, a universal



THREAD MILLING ATTACHMENT FOR SHELL BASE.

grinder not in use on shell work was converted into a thread-milling device. Same is of particular interest, as it demonstrates what may be done by using a standard machine for special work when ingenuity and resourcefulness are brought into play. It was only necessary to attach a special head, as shown in line cut, this head embodying a large bearing which receives the shell. The bearing being bored and split makes a combination chuck and bearing. On the back end is a master thread of fourteen threads pitch, which works into a nut of the same pitch, so that when the bearing revolves this gives the necessary traverse, as in the case of the lead screw on a lathe. Nearly all parts of this machine were picked up around the shop. For instance, the worm wheel is simply one of the change wheels from a disused standard lathe, while the worm-driving apparatus consists of the driving mechanism which formerly operated the table on the grinder.

After threading, the shell is passed on to a lathe, where the copper band recess waving is done, this being accomplished by means of a cam arrangement on the face plate and already described in connection with the manufacture of shrapnel shells. The last operation before the preliminary test takes place is done on a bench where the shell is secured in a special jig. Here both the top and base threads are cleared of burrs by means of a hand-sizing tap.



H. S. TOOL EQUIPMENT FOR RECESSING SHELL BASE.

Preliminary Test.

The shell is now ready for the preliminary examination, which is practically the same as that for shrapnel shells, consisting of examination for freedom from cracks, flaws, blow-holes, rust and other natural defects, as well as for smoothness of surface. The recess in the base is closely examined also for flaws and gauged for depth and flatness. Notice is also taken that the front thread is cut away to allow extra space for riveting-in the base plate. Every size and measurement is also gauged.

Riveting Base Plate.

After passing the preliminary examination, an important operation is performed. This consists in screwing the base plate into place and riveting it. The base plate consists of a circular disc steel forging with a square head on top. It is first shaped and then threaded with a left-hand thread to conform with the thread in the recess of the base of the shell. After the plate is screwed in place, the shell is mounted on a special jig and by means of a pneumatic hammer, Fig. 2, Plate I., to which a riveting tool is attached, the base plate is riveted securely in place. These base plates have a similar inspection at the same time as

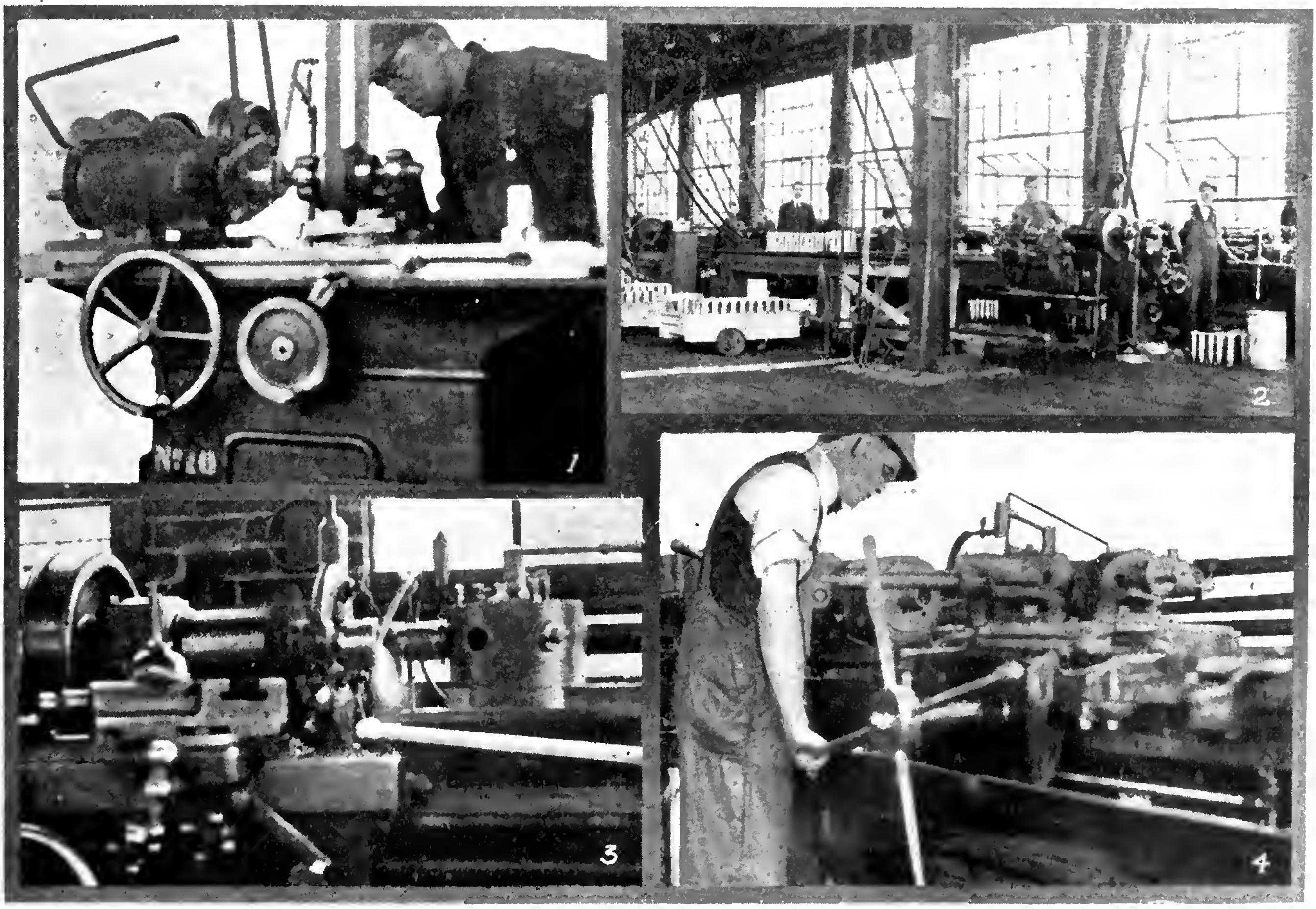


PLATE II.—(1)UNIVERSAL GRINDER CONVERTED INTO THREAD MILLING MACHINE. (2)—GENERAL VIEW OF MACHINE SHOP SHOWING SHELL LATHES. (3)—LONDON MACHINE TOOL CO. LATHE RECESSING SHELL BASE. (4)—JONES & LAMSON TURRET LATHE FINISHING INSIDE OF SHELL.

the shell to guard against physical defects and ensure proper threading and flatness. The head on the base plate is then sawed off, and a hammer test made to ensure the tightness of the plug. A sound test determines whether the plug is loose or not.

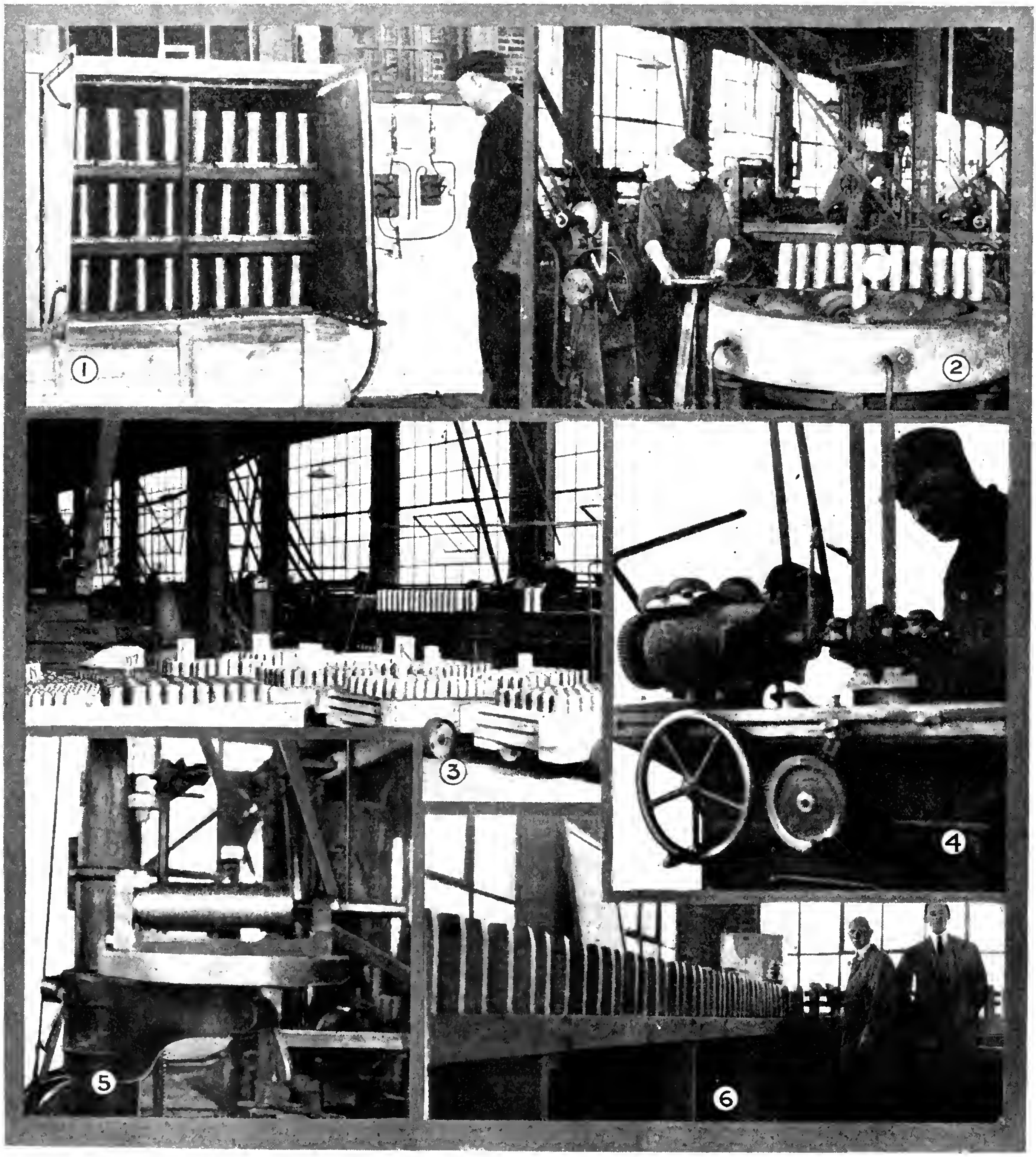


PLATE III.—(1)—ELECTRIC OVEN SHOWING SHELLS IN PROCESS OF BAKING. (2)—MARSH & HENTHORN HYDRAULIC BANDING PRESS. (3) LOTS OF SHELLS READY FOR TESTING. (4)—UNIVERSAL GRINDER CONVERTED INTO THREAD MILLER. (5) SPECIAL JIG WITH SHELL IN PLACE FOR DRILLING GRUB SCREW HOLE. (6) GOVERNMENT INSPECTION DEPARTMENT.

Banding.

An hydraulic banding press, manufactured by Marsh & Henthorn, is next brought into requisition. This is shown in Fig. 2, Plate III. It is of the usual six-cylinder type, having 9-inch rams, and giving 750 pounds pressure. The operation of pressing on the copper band is similar to that for shrapnel shells. When this has been done, the final machining operation is effected. This consists in turning the copper band to size and shape by means of a special tool, and in the same chuck and lathe the finishing face on the end of the shell is accomplished.

Near the top of the nose of the shell a hole is drilled and tapped to hold a small grub screw, which secures the fuse cap in place. This hole is drilled by means of a special jig, Fig. 5, Plate III., placed on the platform of a small drill. The hole is 3/8 of an inch from the top of the

shell, and carries a 13/64 diameter thread. This completes all the mechanical operations necessary.

Final Inspection.

In the final examination, the Government inspector examines and measures with a set of official gauges every part of the shell, and, when found correct, places his initial on it. If found in anywise incorrect and the defect be reparable, the shells are returned to the machine shop, and, following adjustment, are again inspected.

Besides correctness of size, the thread in the top for the fuse must conform with the Government standard. The body gauging is also repeated in the final examination. The copper driving band is examined and tested, gauged for diameter, rib and for seating of cartridge case. A hammer test is given to the driving band, it being tapped with a small hammer to see that there is no looseness.

The length of the shell over all must lie between 9.39 and 9.55 inches, giving a leeway of 16/100 between the longest and shortest lengths allowed. There are 36 separate tests made by the Government inspector on each shell.

Varnishing and Baking.

The varnishing outfit, which was constructed on the premises, consists of a cylinder or container, into which the varnish is poured. The outlet pipe is fitted so as to approach near the bottom of the tank. A small pipe leads from the top of the tank to the compressed air main. The shell is placed over the small outlet pipe and by opening the valve on the air pipe the varnish is caused to flow out at the top of the pipe in the form of a spray, the operation being done instantaneously. The shells when varnished are placed in special shaped castings on the top of a trough, into which the surplus varnish drains, being later returned to the varnish reservoir.

A special electric oven was designed by the plant superintendent and built to accommodate 150 shells in three rows of 50 each. It is arranged for three heats, high, medium and low. The oven operates on a 250-volt, three-phase circuit, and consumes 8 kilowatts per hour. It has the special advantage that one may reach into it and place the shells in their respective places. Eight hours is the baking time allowed for the shells in the oven at a temperature of 300 degrees F. The oven is equipped with a recording thermometer. After varnishing, the shells are painted two coats of yellow ochre, and on leaving the works they must show all inspection marks, physical properties and the series mark, code and heat numbers.

The weight of each shell unpainted is 14 pounds 12¼ ounces, minus or plus 1 ounce, and the painted shell 14 pounds 12½ ounces, minus or plus 1 ounce, which is eight times the leeway allowed in the making of a shrapnel shell. When packed in boxes provided by the Government—six in a box—the shells are ready for shipment.

ELECTRIC OVEN READY TO RECEIVE SHELLS FOR VARNISH BAKING.

SHELL SHIPMENTS.

INSTRUCTIONS, we understand, have been received by the various shell manufacturers in Toronto to hold up their shipments until further notice. The reason is not believed to be due to any notice received from the British War Office, but to the fact that the unfinished shells, which are being manufactured by the various firms throughout the Dominion, are arriving at the explosive factory, where they are being completed, faster than they can be turned into fixed ammunition, ready for shipment to the Old Country.

It is generally believed when Mr. Thomas, representative for Lloyd George, British Minister of Munitions, arrives to make enquiries into the output from this country, that some action may be taken or some suggestion adopted whereby the fixed ammunition problem will be solved and that arrangements will be made whereby Canada will have the facilities for turning out the finished product as quickly as the various manufacturers can turn out the unfinished shell.

THE LONG PULL.

WHY is it that so many customers or potential customers make a practice of demanding a little more capacity than the standard machine provides? For instance, a 2¼ ins. x 36 ins. bar lathe must admit 2⅜ ins. in diameter, or must turn 37 ins. long. A 1¼ ins. diehead must screw 1⅜ ins. A machine swinging 18 ins. will be purchased if it will take an 18½ ins. job and so on.

It does not seem to matter very much what size of machine is in question. Whatever it is it ought to be a little bit more, and the result is that pressure is constantly being put upon designers to make their spindle holes larger, and, therefore, the spindle walls thinner, their centres higher, their beds longer, and so on. It is useless to make the spindle stronger when the hole is increased, as the increased strength immediately prompts a demand for a larger hole still.

If the maker holds his ground and states that his machines will not stand stretching in capacity he is looked upon as obstinate, or as designing too near the limit, or of being ignorant of the strength of his own machines; on the other hand, if he agrees to the stretching process he runs risk of trouble and often renders his machine disproportionate, and, therefore, unsatisfactory in some details. If he permanently alters the design of the machine to make everything right it becomes a larger size than he started with, and so the process goes on, small machines growing into larger ones by passing through a series of periods during which they overgrow their strength.

Every maker of every kind of machine must be familiar with this tendency, but the wise ones are those who decline to play with their factor of safety in the manner indicated by refusing to gratify an unwholesome desire for the "long pull."—Herbert's Monthly Review.

A modern torpedo costs something over $2,000.

Lyddite Shell Production in a Specially Equipped Plant

Staff Article

An installation such as is here described puts the onus of successful production for the most part on the machine tool builder, and, as to how the latter has met the requirement as far as 3.3 high explosive shells are concerned, a careful study of the operation illustrations and text data will make the position clear. It will also evidence the ingenuity of the management.

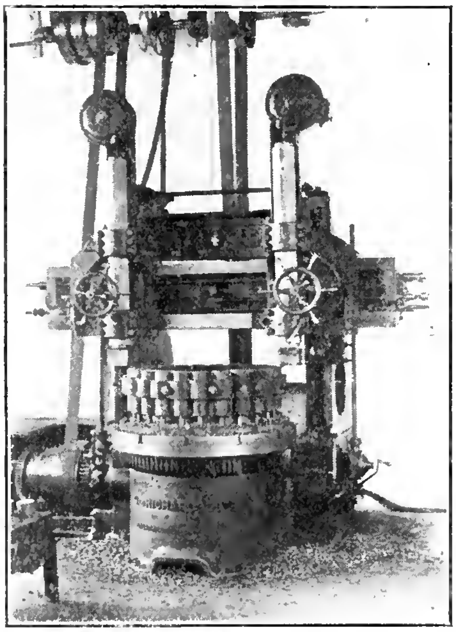
THE manufacture of high explosive shells will possibly arouse more interest in Canadian engineering circles than shrapnel has done. For one reason, the demand promises to be greater. The fact also that they are made for guns of larger calibre as well as for the 18-pdr. weapon lends additional interest. At the present time only 18-pdr. high explosive shells are being made, but 4.5 and 60-pdr. shells are on the tapis for the near future: in fact, preparations are already under way to handle the 4.5 shell.

The explosive used in these shells is lyddite, which corresponds to the French melinite and takes its name from Lydd, in Kent, England, where the British Government first undertook its manufacture. Picric acid is the principal base constituent, and it is one of the most powerful explosives known.

Shrapnel and Lyddite Comparison.

The 18-pdr. lyddite and shrapnel shell vary in many ways, the only feature common to both being the copper-driving band: of course, the outside diameter is the same for both types. From a glance at the line cut on page 1, it will be observed that the shell is parallel and the walls of equal thickness. The closing-in of the nose is dispensed with, the outside of the nose being turned down to the necessary shape. Generally speaking, the manufacture of these shells presents fewer difficulties than shrapnel. No heat treatment is necessary, and, as a consequence, considerable anxiety and trouble is eliminated. Another feature of note is that no forging is necessary, the 18-pdr. high explosive shell being made from a round steel bar 3½ in. diameter, cut approximately to the finished length at the mill.

The machining operations begin at the round steel bar, and are briefly as follows:—Cutting to length on a boring mill to facilitate the work on the automatic machines. The outside of the bar is then rough turned, which includes rough turning the base and counter-boring or recessing the base. The copper band groove is cut and dovetailed, and the wave formed. At the next operation,



TRIMMING H. E. SHELL BARS TO LENGTH.

the remaining half of the bar is rough turned, the nose formed, and the bar rough bored. The bar is next finished inside and the inside of the nose threaded. Following this operation, the outside of body and nose of the shell is finished in a lathe, the base recess finished and threaded, and plug screwed in. After the base has been finished on an engine lathe, the copper band is pressed on and turned up. The shell having been marked, is now ready for varnishing and baking and then painting.

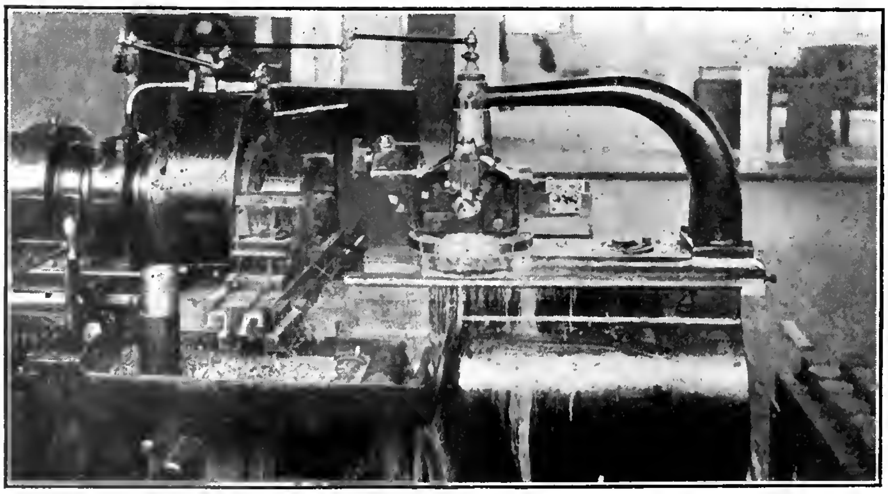
The plant which is the subject of this article was one of the first to engage in the manufacture of 18-pdr. lyddite shells, and the procedure adopted will, therefore, be of special interest. With few exceptions the machine tools and other equipment are new and laid out to suit the order of operations, with a corresponding saving in time and labor. An interesting feature is the installation of several motor-driven automatic machines for the second, third, and fourth operations.

Trimming Bars to Length.

The bars, which are 3½ in. diameter, are shipped from the mill in 9¾-in. lengths, which is rather longer than the finished shell. The ends, of course, are not always perfectly flat and square. To overcome this, and also to cut the bars to the required length, a machining operation is necessary. A vertical boring mill is employed for this work. The mill, which was supplied by George Richards & Co., Manchester, England, has a special casting, fastened to the table, and made to hold 22 bars. Each bar rests on a vertical stop and is clamped to the casting, one clamp holding two bars. The tool, which is set to a gauge, machines the bars to the required length for the next operation.

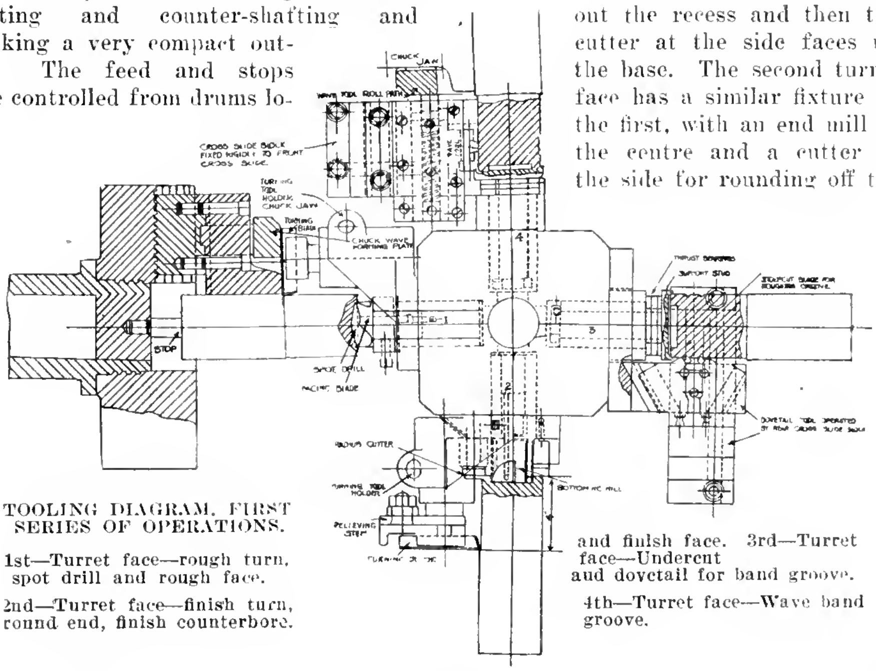
Rough-Turning Shell Body, Recessing Base, Grooving, Dovetailing, and Waving.

A battery of nine No. 6A automatic chucking and turning machines, made by the Potter & Johnston Machine Co., Pawtucket, R.I., is installed for this operation. Each machine is operated by a 5 h.p. C.G.E. induction motor mounted on a motor base and driving through a direct



ROUGH TURNING BODY, RECESSING BASE, GROOVING, DOVETAILING AND WAVING.

gear drive, thus eliminating the usual belting and counter-shafting and making a very compact outfit. The feed and stops are controlled from drums located inside the base of machine. Cutting compound supplied by the Cataract Refining Co., Buffalo, N.Y., is used, and is forced through holes in the drills as well as over the work. Each machine is equipped with a universal chuck on the face of which is attached a three point cam for use in the waving process.



TOOLING DIAGRAM, FIRST SERIES OF OPERATIONS.

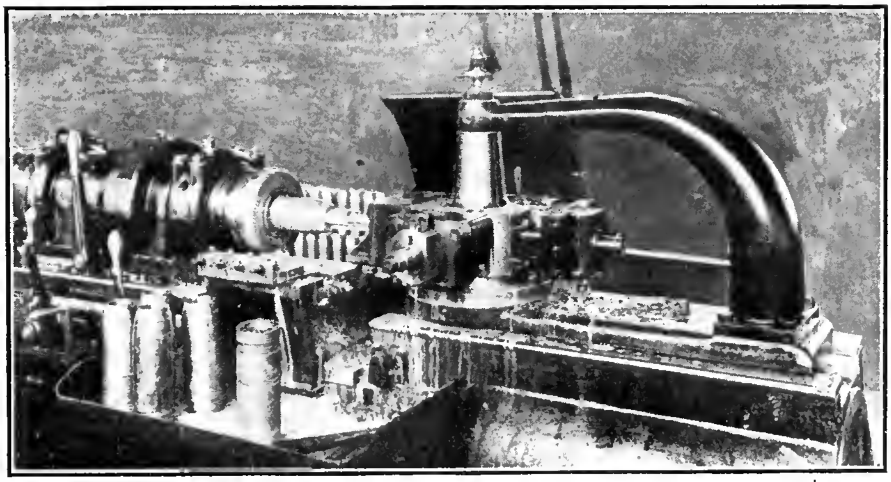
1st—Turret face—rough turn, spot drill and rough face.

2nd—Turret face—finish turn, round end, finish counterbore, and finish face. 3rd—Turret face—Undercut and dovetail for band groove.

4th—Turret face—Wave band groove.

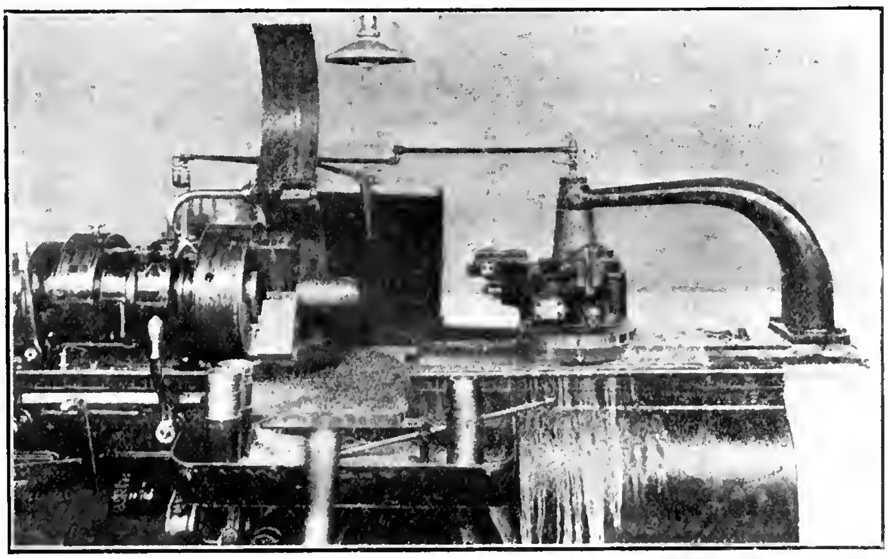
The sequence of operations on these machines is as follows:— Rough-turning outside of bar stock about half its length, machining recess in base, facing-up base and corner, grooving, dovetailing and forming the wave for the copper band. On the first turret face is a bracket fixture, the top part of which overhangs and holds a vertical tool. In the centre is a spot drill and at the side of the drill is a cutter for facing up the base. The turret advances and the vertical tool takes the first roughing cut off the bar. When nearly at the end of the travel, the spot drill roughs out the recess and then the cutter at the side faces up the base. The second turret face has a similar fixture as the first, with an end mill in the centre and a cutter at the side for rounding off the corner of the base. The procedure is the same as in the first case. The vertical tool takes the second cut to within 1/32 of the finished size, while the end mill roughs out the recess in base ready for threading, etc., at a future operation.

The turret now swings round again and presents the third face which has a ball bearing cup centre to hold bar steady, and, at the side, a fixture holding the dovetailing tools. The undercutting tool is held on the rear cross slide block, the tool being under the work. The cross slide is operated by means of a separate cam and drum. The undercutting is done at the same setting as the dovetailing which now follows. The dovetailing fixture, when in operation, is at the far side of the work from the operator. It consists of two small holders each holding a hook nose type of cutter and working in diagonal slides. The cutters are forced in by a push block fastened to top of the cross slide block referred to above. To get the required depth of dovetail, adjusting screws are fitted. Great care must be exercised in setting these tools as the slightest maladjustment may cause the rejection of the shell if the slot is too wide. Sufficient metal is left after undercutting to form the wave which is next cut.



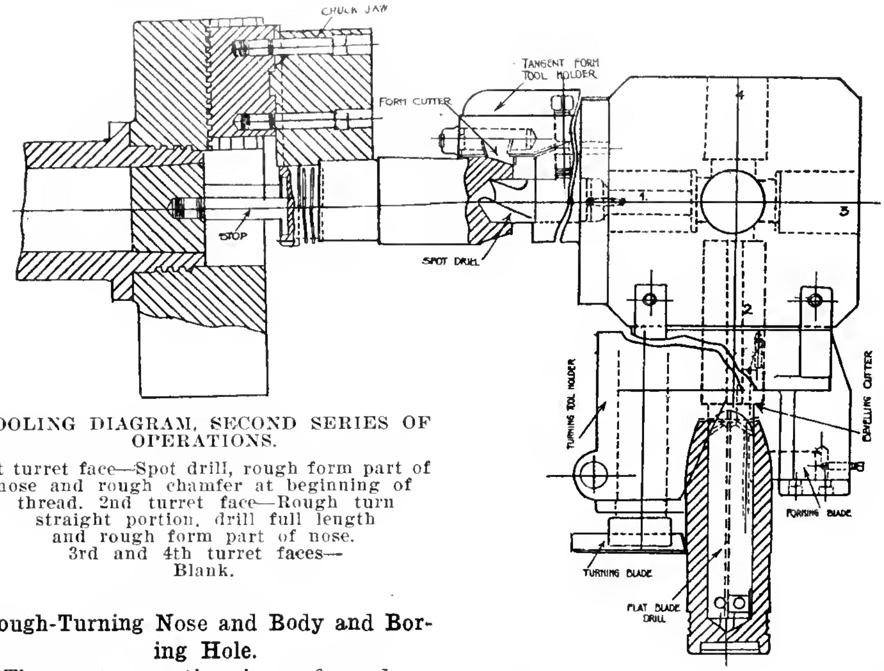
FINISH BORING, THREADING NOSE, FORMING FUSE PLUG SEAT AND RECESS.

The fourth turret face carries a cup-shaped ball bearing centre for holding the shell bar steady during the waving operation. The waving is done by means of a bar sliding in a block fastened to the cross slide, this fixture, of course, being at the side of the work. At the end of the sliding bar is a roller which runs up against the face of the cam fastened to the chuck. This cam is so made as to generate the required form to the wave. The roller is held up against the face of the cam by a spring inserted in the under part of the sliding bar. There is always tension on this spring, and more so when the roller is against the cam face. It is necessary to have a strong spring to ensure a perfect wave on the shell. The cutter is held in the sliding bar and is made with two recesses or



ROUGH BORING, ROUGH TURNING OUTSIDE BODY AND FORMING SHELL NOSE PROFILE.

vces. It is adjustable and set at any angle, and can be taken out, ground and put back without much trouble.



TOOLING DIAGRAM, SECOND SERIES OF OPERATIONS.

1st turret face—Spot drill, rough form part of nose and rough chamfer at beginning of thread. 2nd turret face—Rough turn straight portion, drill full length and rough form part of nose. 3rd and 4th turret faces—Blank.

Rough-Turning Nose and Body and Boring Hole.

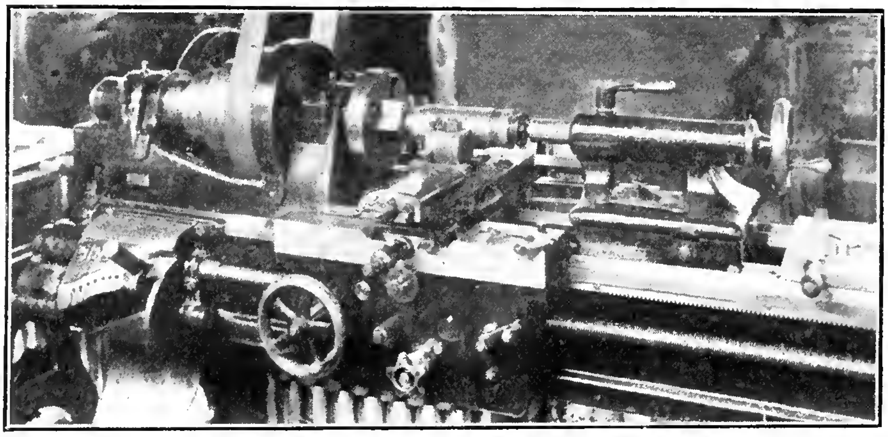
The next operation is performed on a Potter & Johnston motor driven automatic. There are nine of these machines of identically the same type as used for the previous operation except for the tooling. This operation consists of rough-turning the outside of bar—the part not machined at the previous operation, rough-turning or forming the nose, rough-boring the hole and facing up the nose end. The bar is of course solid and square at the end and considerable metal has to be removed at this time.

The first turret face holds a fixture with a spot drill in the centre and a forming cutter in the holder above. This drill enters a short way into the bar preparing the way for the second drill. The cutter at the top forms the front half of the nose curve. The second turret face holds a long cutter in the centre and a fixture with overhanging bracket holds a vertical tool very similar to the one used in the previous operation. At the side of the drill is a holder containing a cutter for forming the second or back half of the nose. While the hole is being bored out, the vertical tool on the fixture is completing the rough turning of the outside of bar. At the base of the boring bar is a small cutter for forming the taper fuse plug seat inside the nose which is done while the drill is finishing the cut.

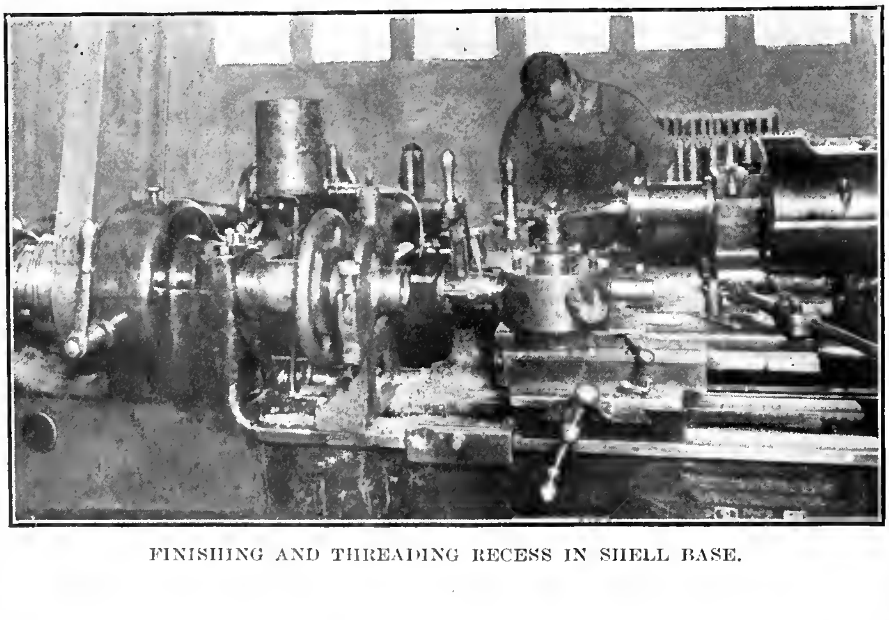
Cutting Recess and Threading Nose.

The next operation consists of finishing the inside of shell, cutting recess in nose, threading same, and cutting shoulder outside at the end of the nose. A battery of six Potter & Johnston automatic machines are employed for this operation. They are the same type as used in the two previous operations except of course for the tooling and also a collet chuck, the latter being operated by a drawback mechanism. The first turret face holds a boring bar which makes the finishing cut inside the shell including the base formation. A single point tool located at the desired position on this boring bar bores the exact diameter for nose threading. At the next setting a tool with two cutters is employed, one of which is for forming the shoulder on the outside of nose and the other for facing up the fuse plug seat. A bar stop on the turret controls the depth of cut.

The third turret face holds a fixture for forming the recess inside the nose at the end of the threaded section about $1\frac{1}{2}$ in. down from the end of nose. This recess is for a clearance space when threading the nose. The fixture consists of a vertical slide which operates a tool holder mounted on the turret face. A suitably shaped cutter is held in a bar in the holder. The turret advances and at a given point the bevelled stop on tool holder engages with a similar shaped stop fixed on the cross slide. This forces the tool up, thereby cutting the recess. At the fourth setting, the nose is threaded by a "Murchey" collapsible die. This operation finishes the inside of the shell.



FINISH TURNING SHELL BODY ON ENGINE LATHE.

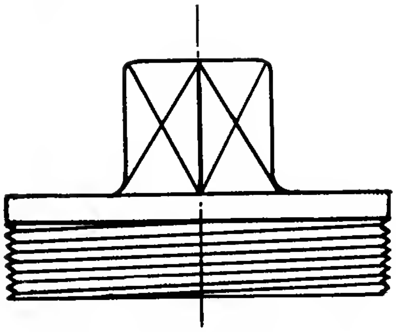


FINISHING AND THREADING RECESS IN SHELL BASE.

Finishing Outside of Shell.

After leaving the automatic machines the shells are taken to a bench and gauged all over. They are then moved to

a lathe for the outside to be finished. An ordinary engine lathe is used for this operation, the lathe being equipped with a face plate having a special driving attachment which engages with the square end of a threaded centre plug screwed into the shell. To insert this centre plug at the nose end, the shell is held in a special bench chuck. For the tailstock end, a centre is used with a taper end for fitting into the recess in base of shell.



FORGED STEEL BASE PLUG.

An ordinary turning tool is used and one cut is taken off the full length of the shell including nose. The cut is about 1/32nd deep and finishes the outside of shell body. To obtain the correct profile for the tool to follow, a special cam attachment is used. The cam is fastened to a bracket attached to the lathe bed at the back, while a fixture attached to the cross slide extends over the cam and has a roller fastened to it which engages with the cam. A weight is attached to the cross slide extension for holding the tool up to the work. Four lathes are so equipped for this operation, being respectively of "Barnes," "Cisco," and "McGregor, Gourlay" makes.

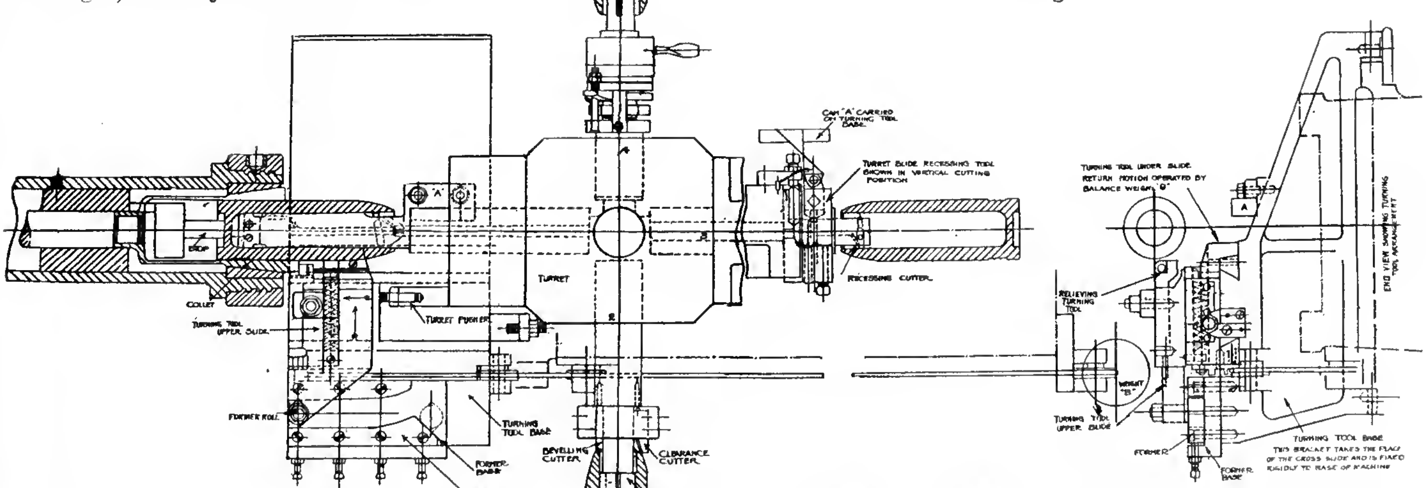
Finishing and Threading Recess in Base.

In addition to the work involved in finishing the base recess a number of minor operations are performed at this stage. After the shells have been turned they are taken to a drill press for the grub screw hole to be drilled. A multiple spindle drill is used for this work. During this operation, the shell is held in a special vise which has an attachment in the form of a jig to ensure that the hole is in the correct position. Alongside the drill is an automatic tapping machine for tapping the grub screw hole. In this case, the shell is also held in a vise with a quick tightening wedge attachment.

The shell is now ready for the recess to be finished. A Warner & Swasey turret lathe is used for this operation. The shell is held in a special chuck and carrier. The first tool bores out the sides of recess, the next tool faces up the base, while the third finishes machining the base and squares up the corners. The fourth turret face holds a collapsible die with left hand threads. The recess is tapped to take a plug which is screwed in at a later operation. The base is next hand-tapped, the shell being held in a special bench chuck for this operation. Careful inspection and gauging of each shell follows, so that any minor defect revealed may possibly be corrected by further machining. For this work a lathe made by the Canada Machinery Corporation is installed.

Fitting Plug in Base.

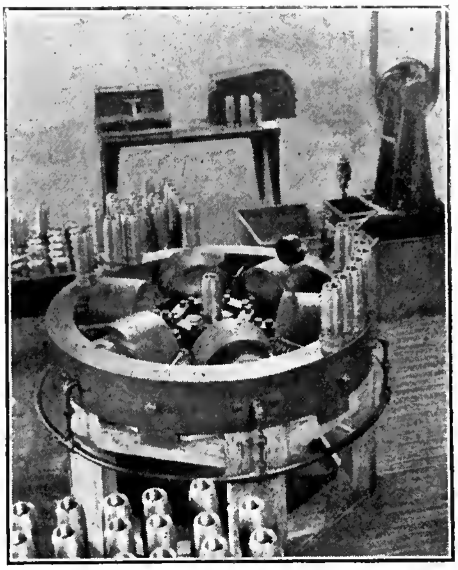
In the manufacture of high explosive shells it is of the greatest importance that there should be no defects and more especially is this so relative to the base. The bar stock is liable to have a "pipe" in it, and the reason for boring out the base and inserting a plug is to overcome this possibility, and at the same time give added strength. If this were not done and any defect did exist there would be a danger of the firing pressure rupturing the base and igniting the explosive, thus destroying the gun, with probable fatal results to the gun team.



TOOLING DIAGRAM THIRD SERIES OF OPERATIONS.

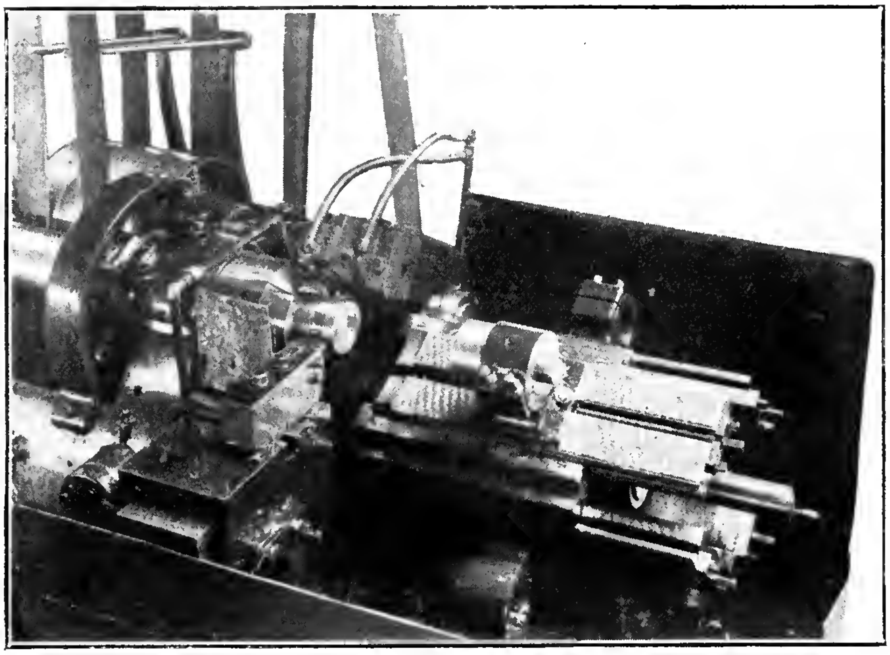
1st turret face—Finish turn with one continuous cut from end of nose to a point to meet finish cut taken in first series of operations. Finish size hole and finish form bottom. Finish bore for thread. 2nd turret face—Finish cut bevel at beginning of thread and form clearance at end of arc. 3rd turret face—Recess for thread. 4th turret face—Tap.

The plug is a homogeneous steel forging, see illustration, faced up, and threaded to suit the counterbore or recess in the base, the threads of course being left hand. The square head is for the tightening wrench and is cut off later. The plugs are machined in a turret lathe supplied by the Seneca Falls Mfg. Co., and involves quite a simple operation. The plugs are screwed in by hand on a bench equipped with box chucks, the threaded portion being covered with a mixture of tar, shellac and rubber cement. They are inserted and tightened up by means of a long handled wrench, and are tapped with a hammer to ensure bottoming.



CANADIAN FAIRBANKS-MORSE BANDING PRESS IN FOREGROUND AND "BERTRAM" MARKING MACHINE IN REAR.

The next operation consists of cutting the square head off the plug, rolling and machining the base. This is performed on an engine lathe with ordinary tools.



COPPER BAND TURNING ON A "GRIDLEY" SINGLE SPINDLE AUTOMATIC.

The lathe has a special chuck and carrier. A parting tool is first put into the holder and the square end cut off. A rolling tool now replaces the parting tool and the joint between the plug and base of shell is closed up. A turning tool is then put into the holder and the base finished up. The shell is now ready for the copper band.

Banding Operation.

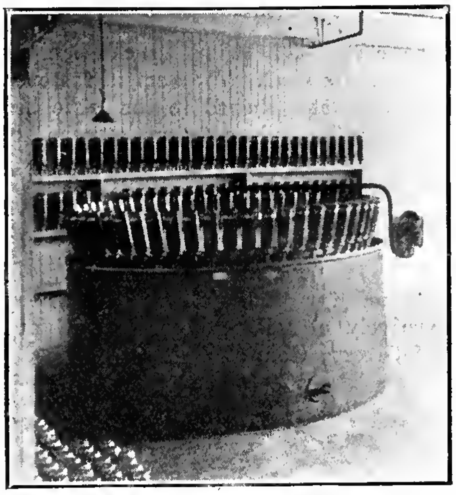
The hydraulic banding press was built by the Canadian Fairbanks-Morse Co., Toronto. It has six cylinders working radially towards the centre and is operated by a belt-driven pump. The copper band is slipped into place on the shell, the latter being then set with its base on a plate in the centre of the machine. Pressure is applied through six rams, working in guides whose ends conform to the shape of the band. After the first pressure application the shell is turned slightly around and the first operation repeated, thus equalizing the pressure on all parts of the band. The rams are returned to their original position by six horizontal springs located between the cylinders. A pressure of approximately 800 tons is applied, a pressure gauge registering the exact amount.

Marking Shells.

The markings on the shells are made by a "Bertram" shell-marking machine, this mechanism having been specially designed for this purpose. As will be seen from the illustration, the shell is placed vertically on the machine, and the die travelling in a horizontal direction draws the shell in between it and the bracket and presses the raised markings on the die into the shell. The machine is belt driven and is continuous running.

Copper Band Turning.

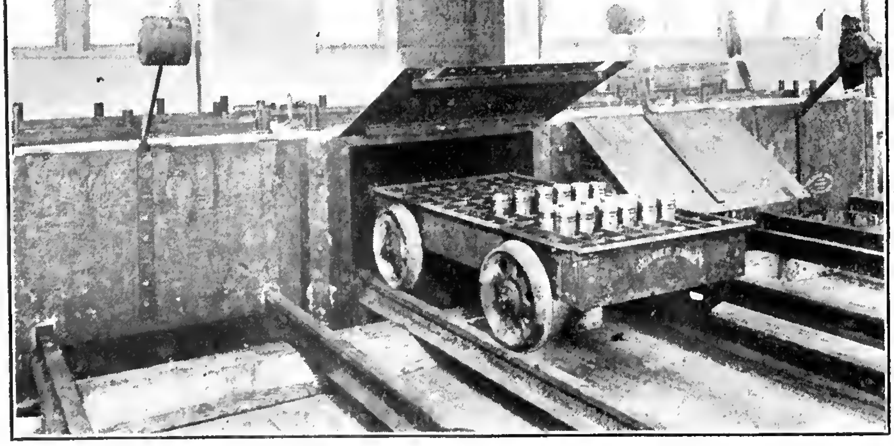
The copper band is turned on a "Gridley" single spindle, automatic machine built by the Windsor Machine Co., Windsor, Vt. The machine is belt driven and is entirely automatic even to tightening the chuck and releasing it at the end of the operation. The chuck is of the collet type usually supplied with this machine and the turret is also standard. The operator places the shell in the chuck and, on starting the machine, the turret travels inwards and locates the shell at the correct distance in the chuck by means of a bracket mounted on the turret. The chuck tightens up automatically and the turret slides back. The arm at back holding the roughing tool now comes over and makes the first cut. The finishing tool in holder on the front sliderest then advances and makes the finishing cut. Immediately afterwards, the tool moves away from the work and the chuck automatically releases the shell which is removed by the operator. By means of automatic devices the spindle is stopped long enough to allow the operator to take out the finished shell and place another in the chuck. The motion of cam drum in the meantime is continued and does not necessitate stopping the machine. The turret is operated by a drum, while the arm at the back and also the slide rest are operated by cams located below the turret. The cutters are, of course, of special design to conform to the finished shape of copper band. The formed face of cutter being true for its entire length, the cutting face only need be ground to sharpen cutting edge. The copper band is now carefully gauged and the shell washed in a soda bath to remove all oil, etc.



CANADIAN LOCOMOTIVE CO. SHELL PAINTING MACHINE.

Varnishing.

The deleterious effect of picric acid upon steel renders it necessary to treat the inside of the shell with some substance that will withstand erosion. A special kind of varnish is used for this purpose, and it must be baked after application to secure hardness. The varnish is poured into the shell by means of a "Bowser" self-measuring storage tank. After the shell is filled, the varnish is poured back into the tank, leaving just a coating all over the inside except at the threads, which are protected by a



GAS HEATED BAKING OVENS SHOWING TRUCKING ARRANGEMENT.

hollow brass plug inserted before the varnish is poured in. The shells are next placed on a draining rack, nose down, previous to being baked. This rack consists of a wooden frame with steel bar sections and a strong steel netting below. The shells rest on the netting and drain into a tray underneath which catches the drippings.

Baking.

Four gas heated ovens are installed for the baking process. The back and outside walls are constructed of brick with steel top, partitions, floors and doors. Under the floors are the gas burners, three for each oven connected to short length pipe outside at the front. The sections have separate connections with the main, thus making it posible to operate any individual oven independent of the others. Each oven has its own set of rails for carrying the trucks, the tracks extending outside. The trucks, four in number, are made of steel and are divided into 120 sections for holding an equivalent number of shells. The shells remain in the oven for 8 hours at a temperature of 300 deg. Fahr. A thermometer on the top of each oven indicates the temperature inside. Each oven door has a balance weight for keeping the door open or closed as the case may be.

Inspection and Painting.

After the shells are taken from the baking oven, the hollow brass plug is removed and the shells undergo the final Government inspection which consists of gauging, weighing, etc. They are then ready for painting. The painting machine installed at the plant under notice was made by the Canadian Locomotive Co., Kingston, Ont., and was specially designed for this class of work. A general idea of the detail of this machine will be seen from the illustration. Briefly, the machine consists of a circular revolving table supported on a frame at a convenient height from the ground. On the top of the frame, and aranged equidistant, are sixty hinged bolts for holding the shells. Previous to being painted, a brass casting is screwed into the nose of the shell, the other end of casting fitting over the hinged bolt.

In operation, the table, driven by a belt, revolves. The painter takes his brush and pushes the shell inward. This causes the bevelled friction surface on the brass casting to come against the bevelled surface of the central revolving table. The shell is thus rotated and the paint applied with the greatest ease. The shells are given a priming and a finishing coat and the nose painted red as in the case of shrapnel shells. Under the table of the machine is a gas heater for drying the painted shells; the frame being covered in on this account. The paint can is supported on a holder outside the machine at the end of an overhanging arm which is pivoted on the post at the centre. After the final coat, the brass casting is unscrewed from the nose and a brass plug screwed in, this plug being similar to that used for shrapnel shell. The shells are now ready for shipping and are packed in strong wooden boxes in lots of six.

General.

It should be understood that this plant is laid out to suit the order of the various operations, thus a minimum amount of labor is entailed in handling the shells. However, trucks are necessary at some stages, and "Chapman" trucks are used for this purpose. To those familiar with the manufacture of shrapnel shells, the absence of heat treatment for lyddite shells will be of special interest as this constitutes one of the most difficult operations that the manufacturer has to contend with in making shrapnel. In making lyddite shells, the scleroscope test is also dispensed with, as is also the preparation of a test piece for Government inspection. A nosing press is not required, which is another saving in outlay and equipment. There are, of course, no bullets in a high explosive shell. The shell is empty when shipped from the shop, the explosive, fuse plug, etc., being added later.

THE SUBMARINE IN WARFARE.

So far as the war has gone, says a correspondent of the Liverpool Journal of Commerce, one type of craft that has proved itself to be more effective than was anticipated is undoubtedly the submarine. It has shown itself to be an almost perfect defence of a coastline against hostile war craft of even the latest and heaviest type. It has proved the most, and, in fact, one might say, the only really formidable weapon against the modern battleship, and has, indeed, rendered it unsafe for large war vessels to patrol the seas. Also leaving aside the question of legality of the new German method of warfare, the submarine has become the strongest possible danger to merchant shipping, thus putting a nation with a relatively weak navy more nearly on a level with a predominant Sea Power.

Starting the war with about 15 submarines of the sea-going, long-range type, and probably never more than 20 at any time, the Germans have been able to sink 12 British war vessels, including three battleships and three large cruisers, and to destroy more than 100 merchant vessels. This, of course, as we know, does not necessarily imply that this latter fact is important from the naval aspect, but it shows us we now have to reckon with the possibility in any future wars of a similar course of action being pursued by one of the warring nations.

Future Naval Design Policy.

No other type of war vessel has done anything approaching the same effective work as the submarine, and from a superficial survey of the whole problem, it might be thought that this has already, once and for all, solved the question of the policy which must be followed in naval design in the future. It might, for instance, be deducted that we, among other nations, must concentrate upon the construction of submarines on an enormous scale, even to the exclusion of building large capital ships. Yet it is obvious, if the matter be carefully considered, that what is undoubtedly the correct policy for one nation would be quite inadvisable in the case of another. In particular a strong naval Power must always keep the offensive most clearly in view, whilst a weak naval Power must necessarily rely upon defensive tactics.

In a sense, the submarine is both an offensive and a defensive craft, but essentially it is the latter, since if we presume that submarines were capable of sinking all the large vessels of an opposing fleet, they would as at present constructed still be incapable of taking the offensive by bombarding an enemy coast or aiding in the landing of an expeditionary force on the hostile coast. Yet against this it has to be remembered that battleships or other surface vessels are in most cases unable to carry out such work, as has already been only too clearly seen during the present war.

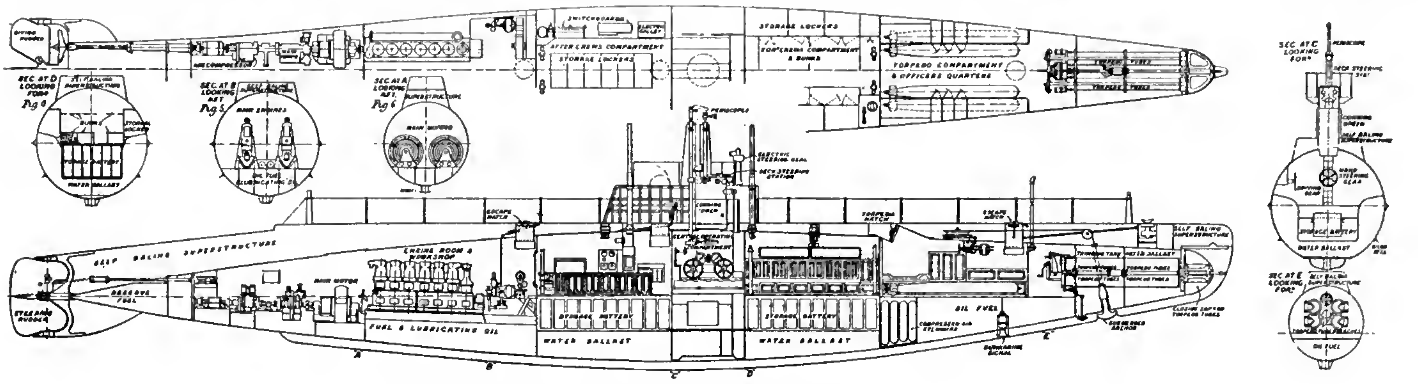
Submarines, if in sufficient number, can always prevent the approach of transports, although they cannot destroy the submarines opposed to them. In fact, it seems that by a combination of a large fleet of submarines, the prolific laying of mines, and effective fort guns, it will be almost impossible for any Power however strong it may be on the sea, to allow its fleet to cover the landing of an army upon hostile shores. In other words, the submarine has added so enormously to the defensive power of any nation that in course of time an invasion by sea will become an impossibility, even in the case of those countries with a very long sea coast and a relatively small fleet.

Naval Predominance Affected.

So much has the submarine thus altered warfare that, from the purely naval standpoint, the predominant sea Power could never inflict a total defeat upon a minor sea Power in the sense of so completely destroying the smaller navy that a landing on a hostile coast could be effected by its aid; for even the destruction of all the submarines—a difficult enough task—would still leave the minefields and fort guns.

The submarine will, therefore, have a

very strong influence upon military tactics in the future, and in particular for those countries which do not adjoin other countries with whom they may, under any conceivable conditions, be at enmity. It follows from this that the submarine has practically rendered Great Britain immune from invasion under any circumstances although it should be added that our submarine fleet has not yet attained such proportions as to guarantee this condition at the present time, and when it has there is always the distinct possibility that some new method of warfare will have been developed.



MODERN TYPE SUBMARINE DESIGN AND LAYOUT—I.

Destroying Submarines.

Submarines cannot destroy submarines, as battleships can destroy battleships, and according to past experience it is not by any means simple for any other type of craft to bring about the destruction of submarines in large numbers. It is true we can help in this direction slightly by building an enormous number of destroyers, but, on the other hand, these are costly vessels in comparison with submarines, and the number required is so very large that one doubts if this method of attacking the submarine problem will ever be carried out on such a scale as to give security of feeling against the depredations of the submarine. The point of importance to be noticed here is that, whilst surface vessels must almost invariably act in flotillas, except, perhaps, very fast destroyers, which can escape from any slower boats, the submarine works most efficiently in single units, and this has been well shown by the recent German tactics.

The time is already here, therefore, when we should consider to what end the path along which all naval progress is tending will lead. We must open our eyes to the dangers of the future, and make preparations accordingly, not after peace has been declared, and we find we have given away some important points, but long before the question of the terms of peace is even discussed.

We must now and onwards continue to develop submarines in this country with more urgency than ever before, and not only must much larger numbers be built in view of possible contingencies, but progress must be made with the type of submarine constructed, particularly in the matter of speed (which means progress in Diesel engine construction), and also in the possibility of under-water craft taking the offensive on a large scale.

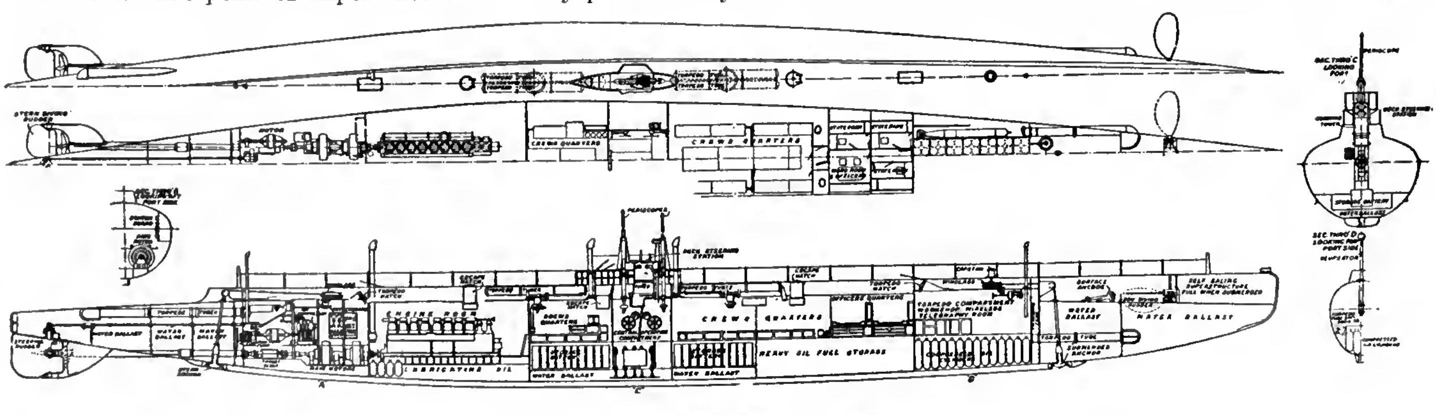
SHRAPNEL SHELL EXPLOSIVES.

THE main propelling charge is invariably of smokeless powder; this is relatively difficult to ignite and a completely satisfactory primer has yet to be found. In every respect save that of smoke, black powder makes the best primer; Krupps use a special cloth woven from guncotton yarn. Most of the smoke produced by modern ammunition is due to combustion of particles abraded from copper driving ing band and is thus hardly avoidable. The mechanical form of the explosive differs in shells of various nationalities.

In American shrapnel, perforated cylindrical grains of nitro-cellulose (about ⅜ in. long by 3-16 diameter) are used. The advantage of perforation lies in greater burning area and more constant surface than that of interstices between cords or strips, so that regular ignition and complete combustion are obtained. On the other hand, unless pressed hard, perforated granules are liable to crush under the gas pressure developed.

German ammunition uses bundles of stick nitro-cellulose about 9 inches long. Cordite has been much used in our shells in the past, but now a crystalline explosive, similar to that in Russian shells, is generally employed. French strip powder (about ½ in. by 1-64 in.) is used in 6-inch lengths. For the bursting charge, black powder is always used, since it gives the right sort of impulse to the bullets and is not affected by the shock of firing the shell.—Engineering Review.

Concerning Shell Orders.—The Canadian Shell Committee have, we understand, advised all those engaged in making shells not to wait for formal orders in the future, but to go ahead and manufacture to capacity.



MODERN TYPE SUBMARINE DESIGN AND LAYOUT—II.

Shrapnel Shell Manufacture

Shell Department of an Air Compressor and Pneumatic Tool Works

Staff Article

To those who have followed our series of articles on "Shrapnel Shell Manufacture in Canada," it will have become long ere this apparent that wide as is the diversity of product of our engineering and metal working plants, nothing in the nature of this new specialty they have been privileged to produce has been in anywise a deterrent to successful accomplishment. The shell department of the plant here described is no exception in this particular feature.

AMONG the large number of shops manufacturing shrapnel shells to-day in Canada, the most interesting ones, from a mechanical standpoint, are those which utilize most fully their standard equipment. This is especially true, because the engineer in charge, or the shop superintendent, must needs have displayed considerable ingenuity in making tools, jigs, and fixtures. The product of the shop about to be described, in times of peace, consists of steam and motor driven air compressors, and pneumatic tools. There are, of course, other lines manufactured as well, but those mentioned will give the reader an idea of the varied nature of the product, and at the same time the varied nature of the machine tools used to produce same.

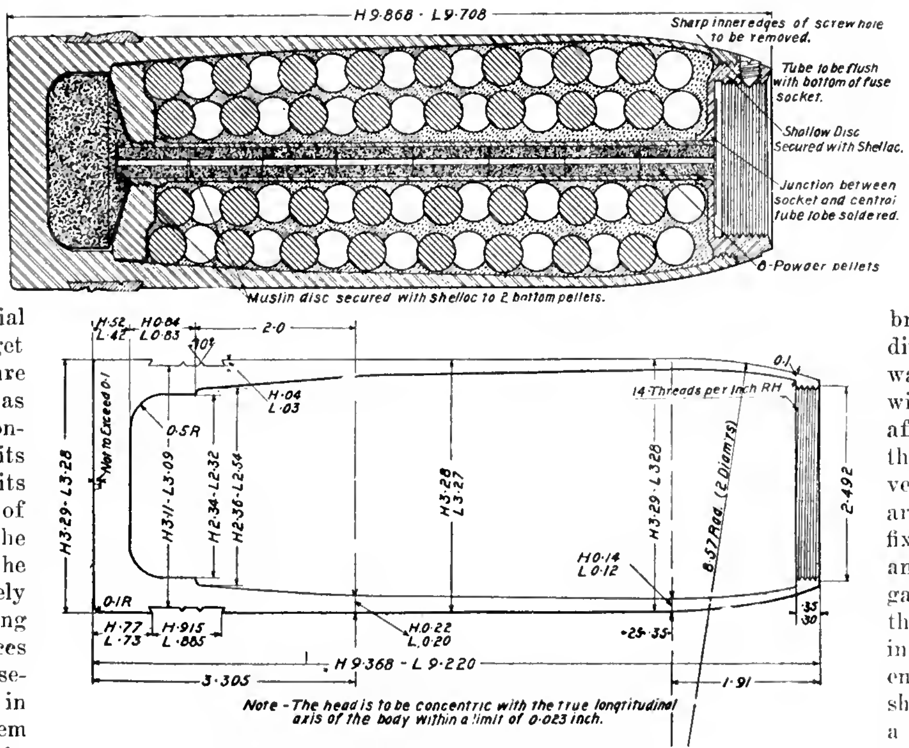
This particular shop was among the pioneers of the Canadian shell industry; in fact, it was our first industrial plant to actually get into the manufacture and to ship shells. It has not, however, been content to rest on its laurels, but has kept its production up to that of the largest shops in the Dominion to-day. The tooling is also extremely interesting, there being a number of devices which are not used elsewhere. Weak spots in the whole shop system are conspicuously absent and the engineering staff are to be congratulated on their high degree enterprise.

Receiving Shells and First Operations.

The shell forgings are received in carload lots from the forging plants, the various shipments having had heat numbers assigned to them there. These heat numbers are useful in determining the heat treatment at a later stage of manufacture. Thus, the shells in one series are all kept together. The word "series" is here used with regard to a number of shells which bear the same heat number. Later the word "series" will be used in another connection.

Sometimes all of a car load of forgings have the same heat number, and then again, among the carload, several numbers may be found. The shell forgings of one heat number all have the same percentage of carbon, hence the importance of keeping a series intact. These heat numbers are removed in the process of rough machining, but on the interior of the shell a daub of paint is placed, a different color representing each heat number. A number of colors which are impossible to mistake are used and a record is kept of all the numbers, and colors assigned to them.

After the shells are received, they are immediately given their "daub" of paint and are placed on trucks, each holding about one hundred forgings. They are then taken to an elevator and carried to the first floor above the receiving floor, where the shell shop is located. On the side of each shell a paint brush, which has been dipped in whiting and water, is drawn lengthwise. This marking, after it has dried, leaves that portion of the shell very white. The shells are next placed on the fixture shown in Fig. 1, and are marked. The gauge is used to scratch the shell, and this mark indicates where the open end is to be faced. The shells are now placed in a Hurlbut-Rogers cutting-off machine, and



BRITISH 18-POUNDER SHRAPNEL SHELL.

are chucked in a universal chuck. Two tools are power fed into the work and the ragged end of the shell is removed. The tools are then drawn out of the work and a rough reamer with a 45 deg. taper is pushed into the shell by hand and all interior burrs are thus removed. This reamer and the fixture in which it works are shown in Fig. 2. Water is used as a lubricant on nearly all the machines in the shop. Some machines have individual pumps, while others are supplied from the small mains which run through the shop. It is from the latter source, that these two Hurlbut-Rogers machines, used in this operation, are supplied. The pump that circulates this soda water cutting lubricant is a little triple vertical belt driven machine, manufactured by W. & B. Douglas, Middletown, Conn.

Rough Turning.

The shells are next carried on Chapman and Cowan elevating trucks and platforms to the various lathes engaged in the rough turning. Several types of lathes are employed, and also various ideas of tooling. Perhaps the most interesting machine is the John Bertram & Sons, Dundas, Ont., engine lathe shown in Fig. 3.

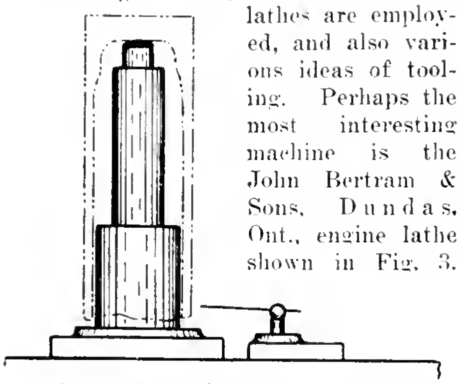


FIG. 1. MARKING-OFF THE SHELLS.

The chuck which grasps the shell is an expanding arbor operated by air. The lathe is of the hollow spindle type, and the air cylinder is placed on the far side of the head-stock. The details of the air chuck are shown in Fig. 4. A special cross slide carrying a turret tool holder is mounted on the carriage. There is, however, but one tool used in this operation, this being traveled along the shell until about two inches of the open end. The diameter is checked-up with calipers and limit gauges. When the tool arrives at this point it is gradually pulled out of the work by hand, forming a rough taper. Finally, when only a light cut is being taken, it is allowed to turn the last half inch of the shell straight.

This constitutes the rough turnings operation. The air chuck is one of the most useful devices yet found, the production on this machine having increased about twenty per cent. since the chuck was placed in service. It is not now necessary to ever stop the lathe to chuck a shell or remove it.

Another interesting lathe is a Lo-swing lathe manufactured by the Fitchburg Machine Works, of Fitchburg, Mass. Fig. 5 shows this machine. No special chuck is fitted, but a special mandrel,

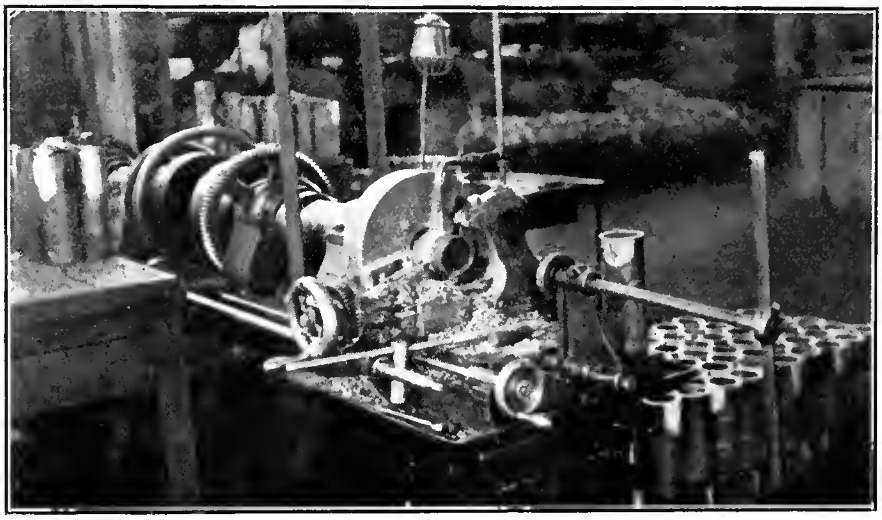


FIG. 2. CUTTING OFF OPEN ENDS OF SHELLS ON A "HURLBUT-ROGERS" MACHINE.

Fig. 6, is placed in the shell. This mandrel is forced into the shell in a Greenerd arbor press. For turning in the Lo-swing with this mandrel, a centre must be placed in the back end of the shells, and this is done on a little drill press. The jig shown in Fig. 6 is placed on the drill table, and the hinged strap A is placed over the top of the jig. A small drill, 5-32 inches in diameter, is run through the pilot hole, care being taken not to have this hole too deep because the back end of the shell when finished must have no marks on it. Thus, the drill is equipped with a stop. The hinged strap is then swung open and the shell and jig are shifted over under the

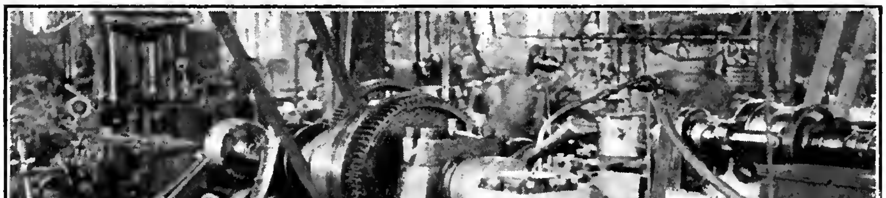
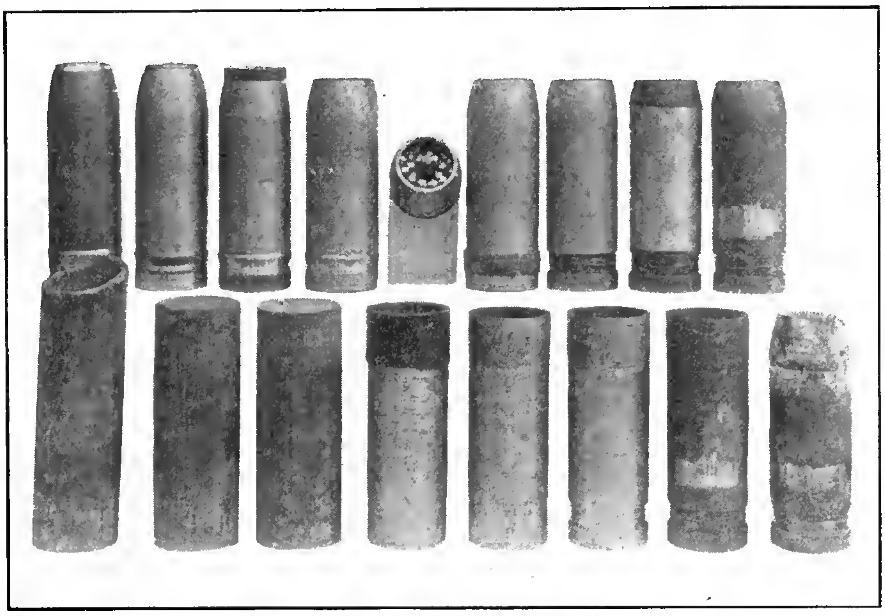


FIG. 3. ROUGH TURNING SHELLS ON A "BERTRAM" ENGINE LATHE EQUIPPED WITH AN AIR CHUCK.

second spindle of the drill press. A tool which forms the centre is carried in this second spindle. A little white lead is put in the centre before placing in the lathe, and a dog placed on the mandrel drives the shell.

The shell is turned straight, from the back end up to within two inches of the open end. A rough taper is then turned and the last half inch of the shell is barely cleaned up and turned straight. One tool accomplishes all this through a modification of the taper attachment of the lathe. A second tool is used to finish turn the base end of the shell up as far as the driving band groove, this tool entering the work while the roughing tool is also turning. Calipers and limit gauges are used to test the work.

Several other lathes are used in this operation, all of which are hollow spindle machines with expanding arbors fitted to them. The arbors are operated through a hand wheel which is keyed to a rod extending through the hollow spindle of the lathe. The first in this group is an F. E. Reed engine lathe. The



SHELLS IN PROCESS FROM THE FORGING TO THE PRODUCT AS COMPLETED IN CANADA.

shells dealt with here have a centre in the back ends, the tail stock being brought forward and the outer end of the shell supported by this centre. The next machine is an American Tool Works engine lathe, the centre in the tail-stock of same being used to support the outer end of the shell. A John Bertram & Sons engine lathe is also employed for a similar purpose.

Two Gisholt turret lathes are fitted with these expanding arbors. The tools are carried on the cross slide, and in one instance the turret carries a centre which supports the outer end of the shell. In the case of the other lathe, the outer end of the shell goes unsupported. To each of these chucks there are two sets of three jaws, the jaws being pulled out of the work by small circular pieces of flat spring steel which have been split. One of the Gisholt turret lathes carries a small dog on the inner end of the shell to relieve the mandrel from the whole driving strain. Only one tool is used on all these rough turning lathes except in the case of the Fitchburg Lo-swing lathe.

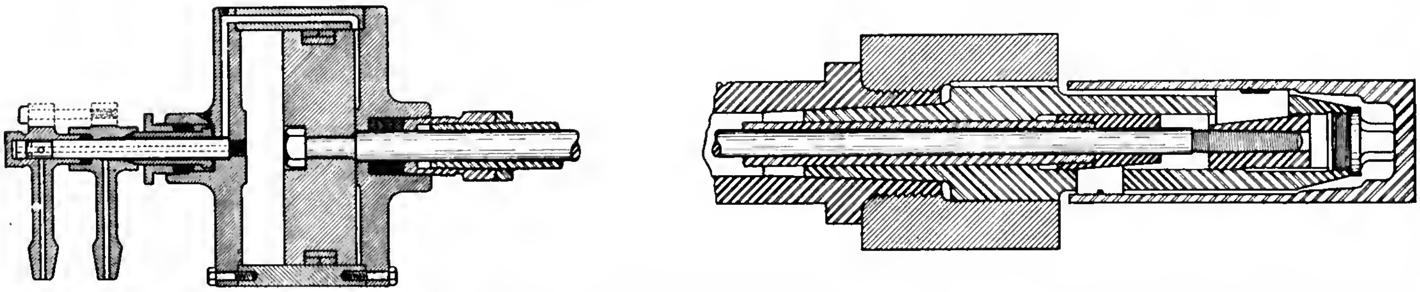


FIG. 4. DETAILS OF AIR-OPERATED CHUCK ON A "BERTRAM" HOLLOW SPINDLE ENGINE LATHE USED IN ROUGH TURNING OPERATIONS.

Rough Facing Back Ends.

The shells are next taken to the large boring mills, where the back ends are faced off. The first machine on this work is a Baush Machine Tool Co., of Springfield, Mass., vertical boring mill. On the table a jig is placed to which twenty-four shells can be bolted. Both heads of the machine are utilized. On one head the first tool is carried, this tool being set so as to take the first cut which varies considerably in different shells. On the other head three other cutting tools are carried which remove more metal from the back of the shell. Thus the strain upon the machine is divided. Fig. 7 shows the machine at work.

A similar Bullard boring mill is used to accomplish this work, a second jig to which twenty-four shells are clamped being used. Only one head, however, is employed, three tools being mounted on it. A third boring mill, also a Bullard vertical machine employed on this work is fitted with a chuck, and only one shell at a time is faced.

It is proposed in this shop to fit up a large Ingersoll miller and in the near future this machine will no doubt take care of the larger part of the work involved in rough facing the shell cases.

Finishing Back Ends.

The finishing of the back ends is done on a variety of small lathes, the operations largely resembling each other, although several types of chucks are used. There are two small John Bertram turret lathes, these being fitted with hinged chucks which screw on to the live spindles of the lathe and are supported in an outer bearing. These details are clearly shown in Fig. 8, which illustrates one of these machines.

The operation consists of finish facing the back end and finishing the outside diameter of the shell from the back end up as far as the driving band recess. Then a radius of 1-10 of an inch is turned on the corner at the base. These operations are usually accomplished with one tool, the cutting edge of which has been ground to a special profile.

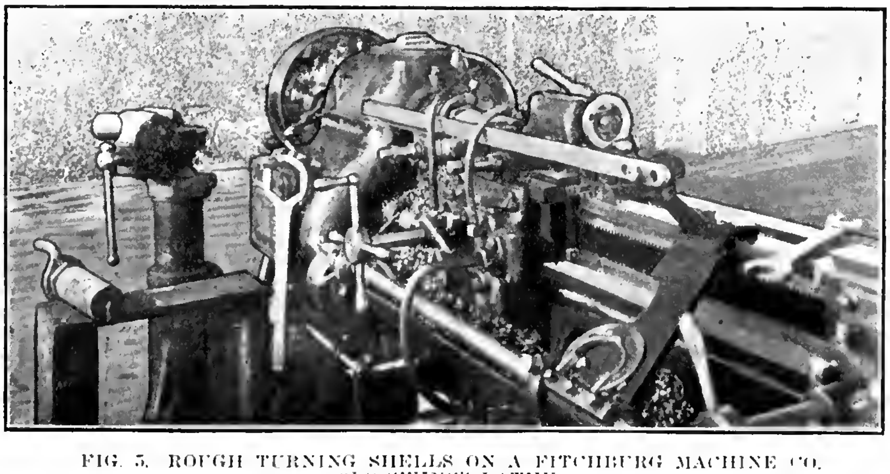


FIG. 5. ROUGH TURNING SHELLS ON A FITCHBURG MACHINE CO. "LO-SWING" LATHE.

Two other lathes

engaged in this work are R. McDougall, Galt, Ont., machines. One is equipped with a split collet chuck carried in an outer bearing. As the nose is at this stage of manufacture the largest diameter of the shell, a split bush is slipped over the latter and the collet jaws tighten down on the bush, thus the shell is quickly and easily gripped in the chuck. The second chuck is a hinged pattern carried in an outer bearing. These operations are final on the back end of the shell, and are followed by that of boring.

Boring.

The shell now passes on to the Jones & Lamson turret lathes where the powder pockets and diaphragm seats are bored. Four Jones & Lamson flat turret lathes and two more J. & L. turret lathes of an older design, are all employed for the same purpose. Each lathe is equipped with a hinged chuck and the shells are placed in these up against a stop. The boring tools are quite simply arranged. One bar extends across the turret and the end extensions are the boring bars carrying the boring tools. The roughing cutters are carried on the one end extension, that is, the roughing cutter which bores out the powder pocket and the diaphragm seat. On the clamp nearest the roughing bar extension, two fixtures are bolted which carry two small tools. These tools rough turn the outer diameter of the shell and face the end of it. By referring to Fig. 9, a diagram of the tooling is shown. The lathe is equipped with stops which govern the depth to which the tools enter the work.

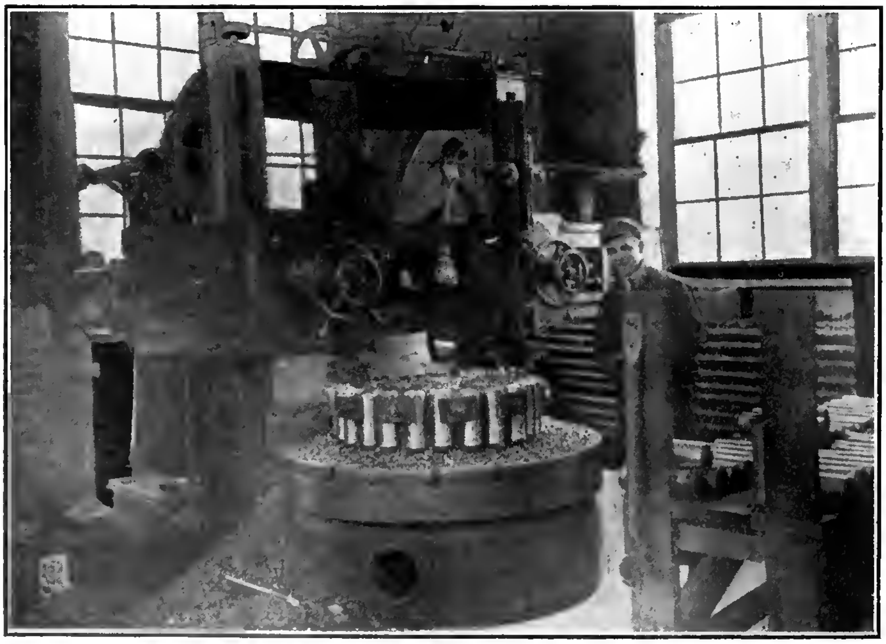


FIG. 7. FACING BACK ENDS OF SHELLS ON A "BAUSH" BORING MILL.

On the opposite end extension, the finish cutters are carried, and, as in the case of the roughing cutters, these cutters are made from one piece of steel. The cutter has two cutting edges which are ground so as to form the powder pocket and diaphragm seat. The tool is placed in the bar horizontally, and held

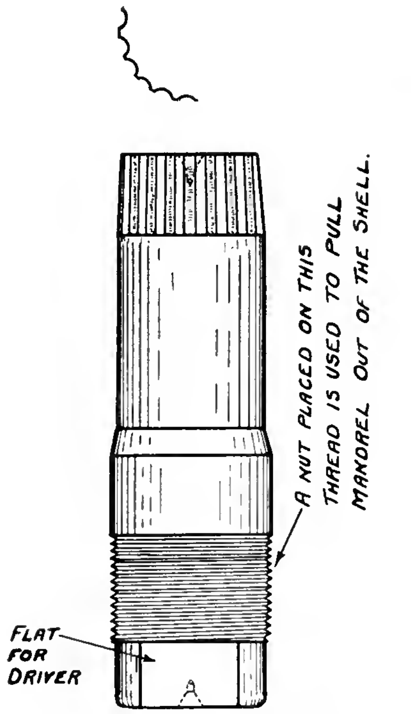


FIG. 6. MANDREL USED IN ROUGH TURNING OPERATIONS ON "LO-SWING" LATHE.

firmly there by means of the shape (being dovetailed into the bar) and two set screws. The finish cutters are fed into the proper depth against stops. Fig. 10 shows a three-hundred and fifty-pound operator on one of the Jones & Lamson flat turrets. Soda water cutting lubricant is fed to the cutters through ducts in the boring bars, and all of the six machines engaged in the boring operation are tooled up in a similar manner.

After the boring operation, the thickness of the metal in the bottom of the shell is tested with the gauge shown in Fig. 11, at A. The gauge B is used to

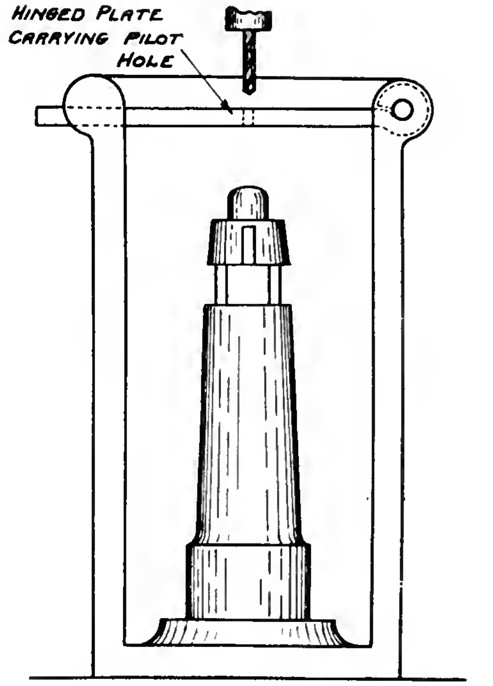


FIG. 6. JIG ON DRILL PRESS TABLE FOR CENTERING BASES FOR TURNING ON "LO-SWING" LATHE.

test the length of the shell. From these machines the shell passes on to have the driving band recess cut.

Machining the Driving Band Recess.

The operation of turning the driving band recess is done on three Potter & Johnston "automatics," as shown in Fig. 12. The shell is placed in a universal chuck, up against a stop, and a tool advances from the rear of the machine and roughs out the groove from the under side of the shell. The tool turns to finish depth on either side of the groove but leaves sufficient metal for the wave lines to be later formed in the central portion of the groove. Then the undercutting tools from the rear enter the work and undercut the edges of the groove. After this operation, the wave-forming tool from the front of the machine advances toward the work. This tool has its cutting edge so formed that it leaves two small "V"-shaped ridges. A three-pointed cam bolted to the face of the chuck communicates to the tool-holder a lateral motion which transforms the "V"-shaped ridges into waved lines. These operations are so arranged as to be automatic, and, after the shell is chucked, nothing need be done by the operator until it is necessary to remove the shell. Lard oil is used as a cutting lubricant on all three machines, and is, of course, supplied from an oil pump which forms part of the machine itself.

Two other machines are employed to

accomplish the machining of the groove. These are a Jones & Lamson turret lathe and a John Bertram & Sons engine lathe. The shells, however, have the groove roughed out and formed on a John H. Hall & Sons cutting-off machine, before being set up in either of these two machines, this one Hall machine being quite capable of feeding the other two machines. The shell is simply chucked in a universal chuck and a rough-turning tool is fed into the work. This rough-turning tool cuts the groove roughly to width. The outside edges of this rough turned groove are cut to depth, while sufficient metal is left in the central portion of the groove to allow of the wave lines to be later formed. This operation is of rather short duration, thus the machine is able to feed a Jones & Lamson turret lathe and a Bertram engine lathe in performing the finishing operations.

The Jones & Lamson turret lathe is equipped with the tooling for finishing the groove as supplied by the manufacturers. A little fixture has, however, been added at this shop in connection with the under-cutting tools. One under-cutting tool is fed from the rear of the machine and the other from the front. The little device added here centres these tools when they are not being used, thus allowing the shell to be placed in the machine and removed without coming into contact with the tools.

The Bertram engine lathe is fitted with the Bertram recessing and wave line forming attachments, already described in previous issues of Canadian Machinery. With the completion of the recess, the shell is ready to pass on to the heat treating department.

The hardening furnaces and oil tanks are located in the blacksmith's shop, a general view of the hardening department being seen in Fig. 13. The large furnace shown in the background is a

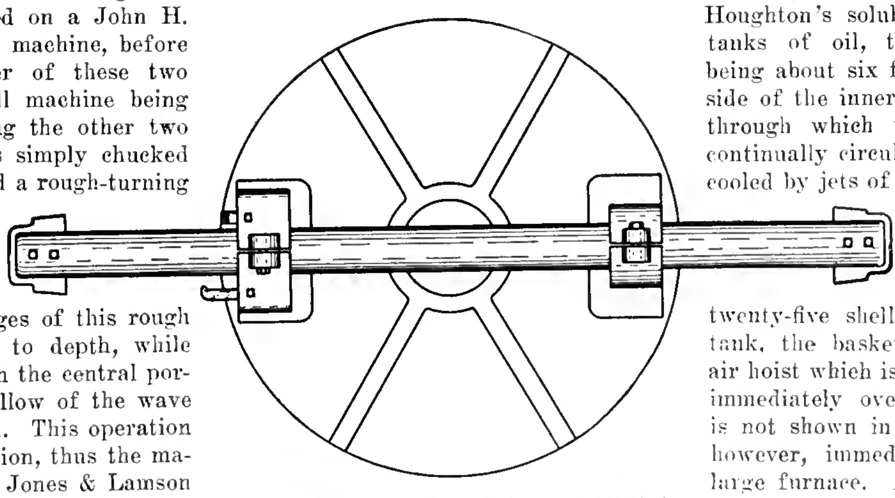


FIG. 9. SIMPLE TOOLING ON A "JONES & LAMSON" TURRET LATHE FOR BORING.

Brown & Sharpe product fitted with Ferguson oil burners. This furnace accommodates twenty-five shells in a batch. They are placed in the ovens one at a time by the tool shown in Fig. 14, and are raised to a temperature of 1450° F., being allowed to stay in the furnace from twenty-five to thirty minutes. The door of the furnace is fitted with a counterweight and is easily operated. There are five smaller oil furnaces each able to take care of eight shells, of which usually three take care of the annealing and two the hardening. They are so fitted, however, that they can be used for either purpose. These smaller furnaces were built by the Canadian Ingersoll-Rand Co., Sherbrooke. All the furnaces are equipped with Bristol pyrometers.

The shells are lifted from the smaller furnaces by specially made tongs, and are pulled from the larger furnace by means of a poker out on the platform in front. From there the shells are taken by tongs and placed in tanks of Houghton's soluble oil. There are two tanks of oil, the smaller of the two being about six feet by three feet. Outside of the inner shell is a water jacket through which water from the mains continually circulates. The oil is further cooled by jets of compressed air and cold water coils in the bottom of the tank. One large woven wire basket containing twenty-five shells is submerged in this tank, the basket being handled by an air hoist which is suspended from a point immediately over the tank. This tank is not shown in Fig. 13; it is situated, however, immediately in front of the large furnace. At one end of the tank is placed an inclined shelf on which the shells are placed to allow the oil to drain from them.

The second oil tank is slightly larger than the first. It is approximately seven feet by three feet, and is equipped

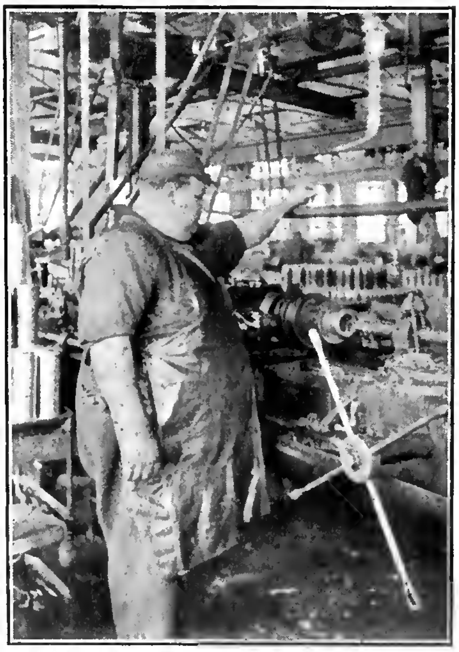


FIG. 10. BORING ON A "JONES & LAMSON" TURRET LATHE.

somewhat more elaborately with devices for keeping the oil cool. The tank is water jacketed similarly to that already described. Jets of compressed air are also employed, but perhaps the most interesting device is the employing of a Wainwright Evenflow Heater, manufactured by the Alberger Condenser Co., New York city, to cool the oil. A small centrifugal pump direct connected to a ¾ h.p. Sprague Electric Co motor circulates the oil through the coils of the heater. Water from the mains is also circulated through the heater, thereby absorbing a considerable portion of the

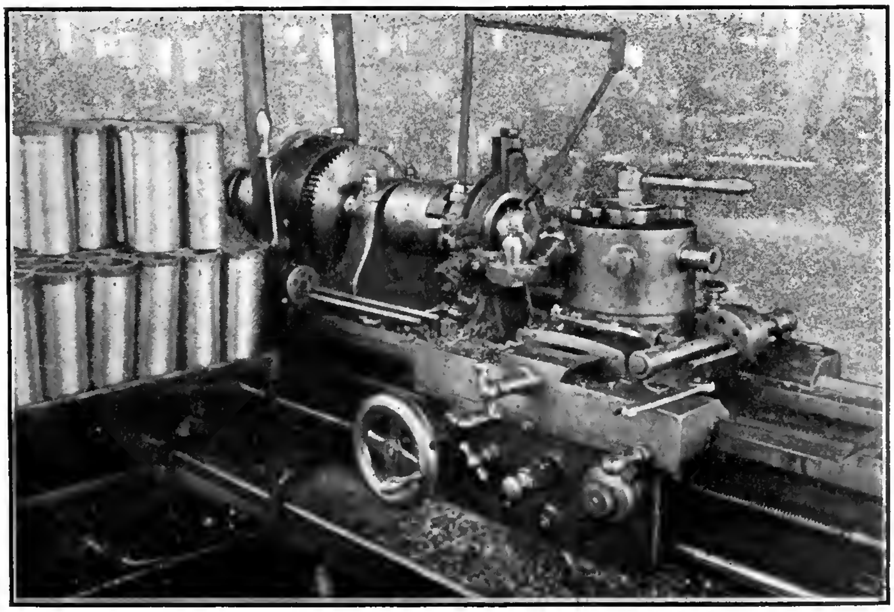


FIG. 8. FINISHING BASES OF SHELLS ON A "BERTRAM" TURRET LATHE.

heat from the oil. The connections of the heater had of course to be rearranged somewhat, but the results have been very gratifying. In addition, this tank also has cold water coils placed in the bottom to further assist in cooling.

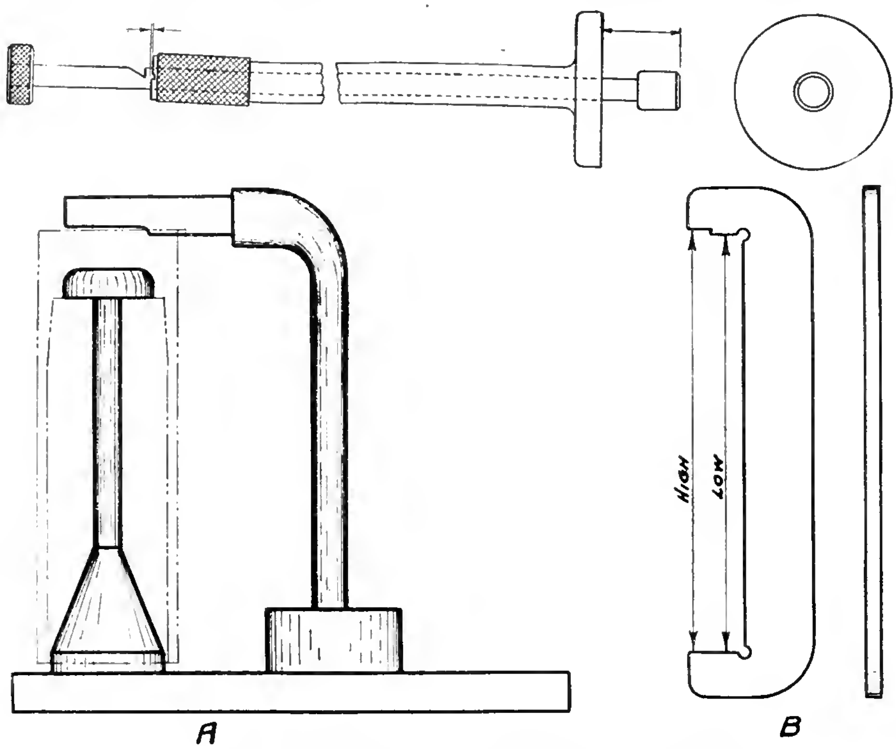


FIG. 11. GAUGES USED AFTER BORING OPERATIONS.

Two small woven wire baskets are placed in the tanks, each of which takes care of eight shells at a time. Handles, which also do duty as supporting hooks, come up over the edges of the tank, thus the basket is lifted by hand up to the shelf at the end of the tank, where it is placed to allow the oil to drain from the baskets and shells. The shelf simply consists of a couple of ¾ inch rods stretched across the tank just above the level of the oil. The shells in this case also are lifted from the baskets on to an inclined shelf where the oil is allowed to further drain from them.

Annealing is carried out in the small furnaces, eight shells to each. The annealing temperature is from 650° to 700° F., and the length of time required for the process is approximately half an hour.

Representative shells are next polished up on a small Landis grinder. The nose of the shell is placed in a small universal chuck driven by a single pulley and on that part representing the tail-stock, a revolving centre is mounted. Thus, the shell is held and revolved, while an emery wheel is brought up to it and a circle cleaned up near the recess. Testing with a Shore scleroscope follows. The methods employed to obtain uniform and satisfactory results from the hardening treatment will be found interesting.

Relative to Hardening Treatment.

As before stated, there may or may not be more than one heat number to a carload of forgings. Each heat number is, however, identified by means of its paint mark. Samples from each heat number are taken, and these are obtained from the ragged ends of the shell cut off in the first machining operation. The samples are examined, and, from experiments conducted, a heat treatment is established. This treatment is then applied to a sample bunch of three shells, and in most cases the shells respond to it. If, however, the shells do not respond, the whole lot of shells of that particular heat number is held up till a satisfactory heat treatment has been determined. When the samples come up to the required hardness the lot is put through. Should it become a difficult problem to get a certain batch of shells to respond to a heat treatment, analyses are sometimes taken, and the problem studied until satisfactory results have been obtained. After annealing, which will be remembered was accomplished in batches of eight, one shell in each lot of eight is cleaned up and tested with the scleroscope.

When one shell passes the scleroscope test, the lot of eight are taken to have passed. Fifteen lots of eight each are now placed on an iron table and the Government inspectors take two shells at random from the lot, being careful to always choose shells that have not undergone the scleroscope test. One of these shells is used for the tensile test and the other for the firing test. Here the shells lose their heat number identification and are made up into series of 120 each. Each series is given a number and this number is used to identify the series throughout the succeeding operations.

Shell Nosing.

The next operation is the nosing process. The shells are heated in a lead pot from which four pipes extend. They are slipped on to these pipes, and thus their noses are placed in the lead and heated. Each shell is nosed on a pneumatic nosing press, after which they are placed in a second lead pot and reheated for a few moments to a dull red. The shells are then placed, nose downward, in large trays of powdered mica. Four pipes for holding shells extend out of each lead pot, and charcoal is placed on the surface of the molten lead to reduce the oxidation of the metal to a minimum. Fig. 15 shows the lead pots and the nos-

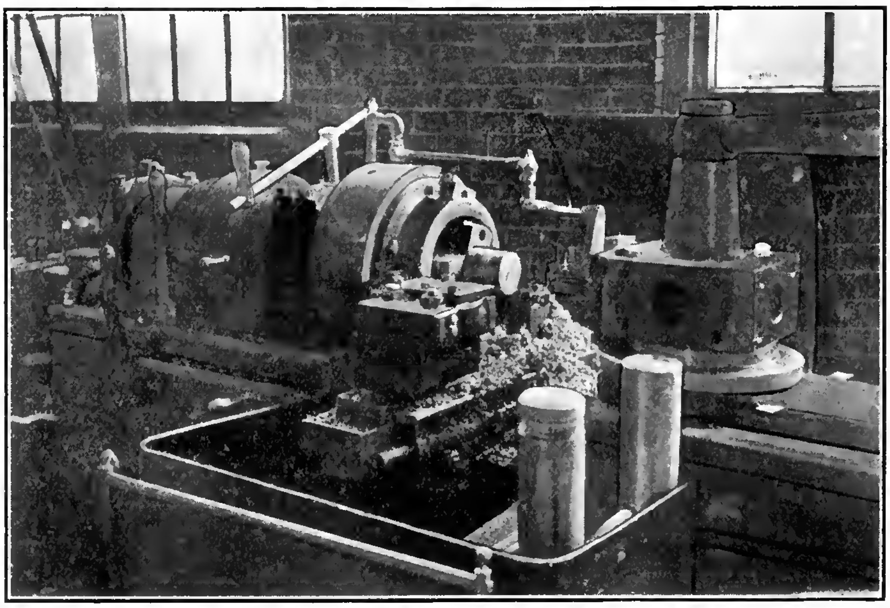


FIG. 12. RECESSING ON A "POTTER & JOHNSTON" AUTOMATIC.

ing press, while Fig. 16 shows the detail of the profile of the die used to nose the shell.

After the noses of the shells have cooled slowly in the powdered mica, they are removed to the foundry where they are sandblasted, all traces of scale being removed from the shell base, recess, and body.

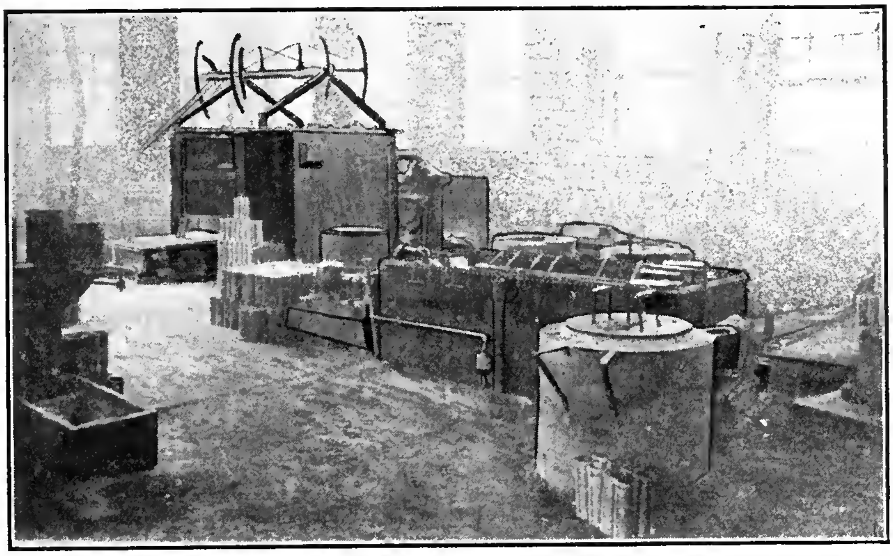


FIG. 13. HEAT TREATING DEPARTMENT.

Machining Inside of Nose.

Several machines are tooled up to accomplish this operation, the list including two London Machine Tool Co. engine lathes, one large Bertram engine lathe, and two small Bertram engine lathes, making a total of five lathes installed in this department. One or two other lathes located in adjacent departments are also tooled up to accomplish this operation should these first mentioned five lathes not be able to take care of the full number of shells sent to them. Fig. 17 shows a London Machine Tool Co. engine lathe fitted up with a turret on the cross-slide and tooled up to accomplish the operation, while Fig. 18 is a diagram of the tools and stops used. The shell is chucked in a collet chuck as can be clearly noted in Fig. 17. A stop in the chuck locates the shell.

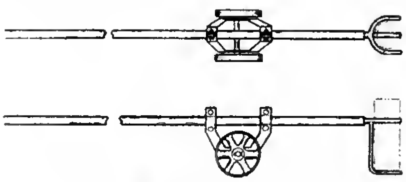
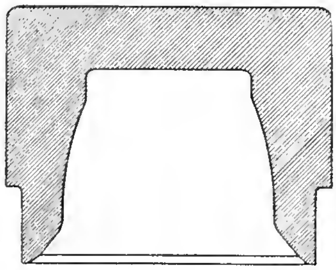


FIG. 14. TOOL FOR PLACING SHELLS IN LARGE FURNACE.

The first operation is to rough turn and form the outside of the nose. By referring to Fig. 18, the fixture, A, can be seen, being rigidly attached to the turret. On the cast iron fixture B, and bolted rigidly to it, is a forming-plate of hardened steel, the near side of this forming-plate being used to guide the turning tool mounted on the turret cross-slide. The tool is fed away from the head-stock, the pin in the fixture A is brought against the forming-plate and the tool located. The carriage is then travelled by power away from the head-stock of the lathe. Hand manipulation of the cross-slide keeps the pin in the fixture A, closely in register with the forming-plate, the outside edge of which is ground so as to form the proper contour of the nose.

The turret is next swung around and a boring bar carrying a boring tool and a facing tool is brought into position, the turret being located for this operation by the stop C. When thus located, the carriage is travelled by power towards the head-stock. The tool D bores the nose, and the tool E faces it. The carriage travels until its motion is checked by the stop at F, thus the nose is faced to length.

The inside of the nose is next turned and formed, the tool G being used for this work. This tool is guided by the forming plate attached to the fixture B. However, for this operation the inside edge is the forming edge. The pin in the fixture A is placed against the tail-stock end of the forming plate, thus the tool is located. The carriage is traveled by power and the pin in the fixture A is kept against the forming plate by the hand manipulation of the cross slide. In this way the inside turning and forming is accomplished.



NOSING DIE

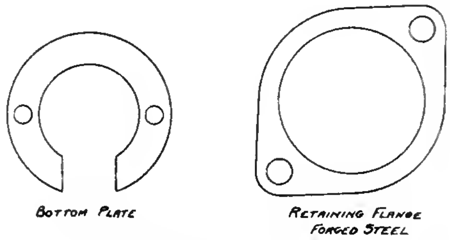


FIG. 16. SOME NOSING PRESS DETAILS.

The next operation is to ream the straight bore of the nose, a spirally fluted reamer being employed to do this work. The turret is centred by means of the stop C, and the reamer, which is of the shell type, is mounted on a boring bar. The turret being swung, the nose is tapped, two kinds of taps, being used

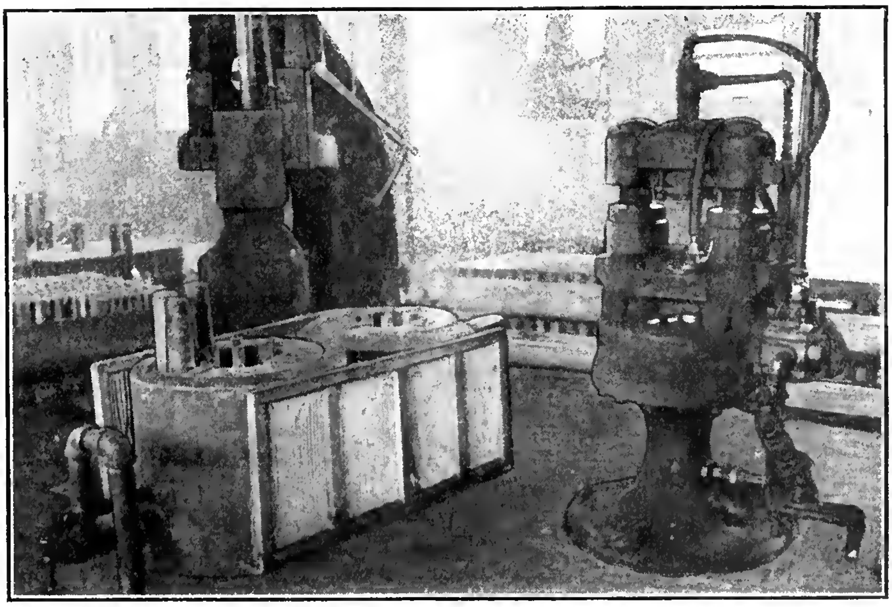


FIG. 15. LEAD POTS AND NOSING PRESS.

—the collapsible type and the ordinary type. The operation of the collapsible type of tap is easy to understand. The straight tap, however, is operated under different circumstances, the straight shank of the tap being fitted with two feather keys, and mounted on a bar fitted to the turret. This bar is of large enough diameter on that portion outside the turret—to be bored out to accommodate the shank of the tap, and two keyways are cut diametrically opposite one another to take care of the feather keys. The lathe is reversed to allow the tap to be withdrawn. Water lubricant is used on all tools in this operation. A very convenient little gauge is used, to test the thickness of the metal in the nose, this gauge being shown in Fig. 19.

The next operation is to put the sizing tap in the noses. This is done on an American drill press. The tap is started in by hand and the drill finishes the operation. Lard oil is used on the tap, but only in small quantities; the reason of this being that if there is any surplus oil in the shell when the resin is poured in, the latter will ignite it which is undesirable.

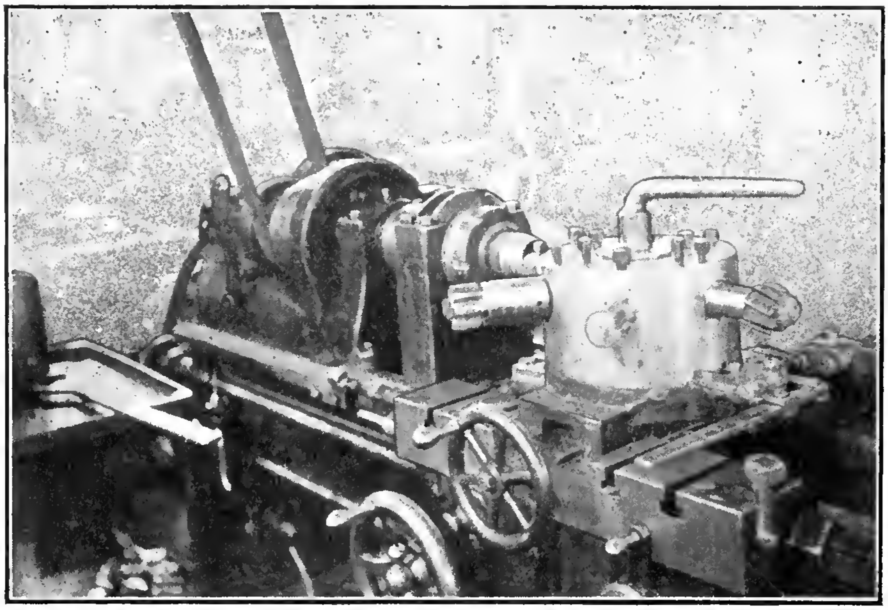


FIG. 17. FINISHING INSIDE OF SHELL NOSE ON A LONDON MACHINE TOOL CO. LATHE.

Finish Grinding.

The shell now has a centre plug screwed in the nose, being held in a clamp on a bench while the plug is screwed in. This bench, on which is located the clamp and the shells, being adjacent to the Landis grinder upon which the noses are ground, makes it very convenient for the operator to pick up his shells and place them in the machine. Fig. 20 shows the plug and the method of driving the shell in the grinders. The base of the shell is carried in a revolving centre mounted on the tail stock. The shells are ground to their exact shape, the wheel being dressed to do this. Care is taken, however, to dress the wheels frequently in order to produce perfect noses.

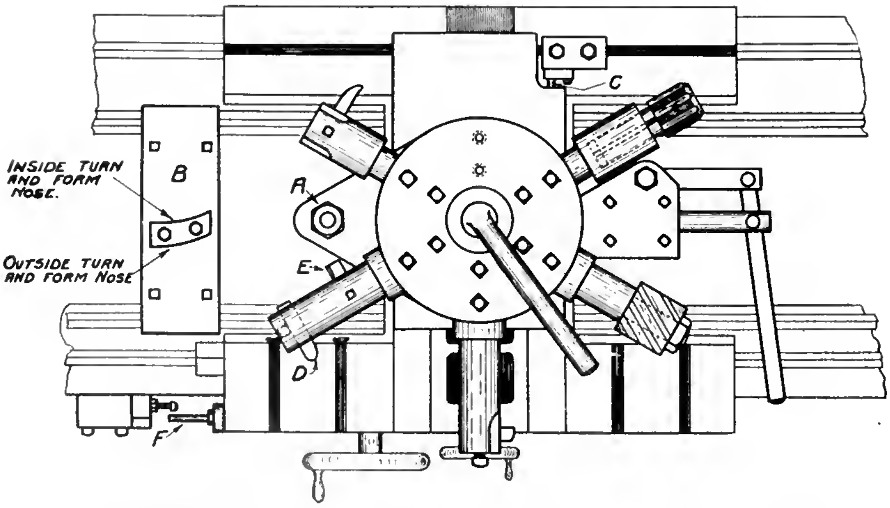


FIG. 18. LONDON MACHINE TOOL CO. ENGINE LATHE EQUIPPED WITH SPECIAL TURRET ON CROSS SLIDE AND SPECIAL TOOLS FOR MACHINING SHELL NOSES.

When the shell is removed from the machine, the operator places it on an inclined track, and it rolls by gravity down to the Norton grinder, on which machine the bodies are ground. A straight wheel of $6\frac{5}{8}$ inch face is used here to grind the bodies. The wheel grinds both the straight portion of the body and also a small bevel where the diameter of the shell is enlarged. The reason for the extra width of face of the wheel is to permit the latter to be worn away considerably before this bevel becomes too short. When the shell is removed from the body grinder, it is placed on another inclined track, and rolls by gravity back to the clamp on the bench where the plug is removed. Fig 21 shows the two inclined tracks and the grinders in the background.

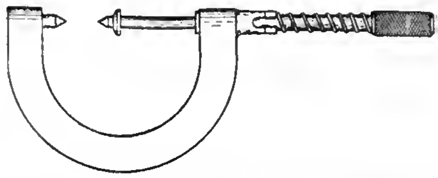


FIG. 19. GAUGE USED TO TEST THICKNESS OF METAL IN NOSE OF SHELL.

A rather unique scheme is being tried out in these operations. It consists of the water used on the grinding wheels being made to flush out the cuttings from the base of the machines and carry it all to a settling tank on a lower floor. From the latter, the water is pumped back again to the little mains which supply the lubricant to the various grinders. It has been found necessary, when these grinders, especially those operating on the bodies, are working at full capacity, to stop several times a day and remove the accumulation from the base of the machine, but with the new arrangement, it is hoped to be possible to operate the machines continuously. A duplicate set

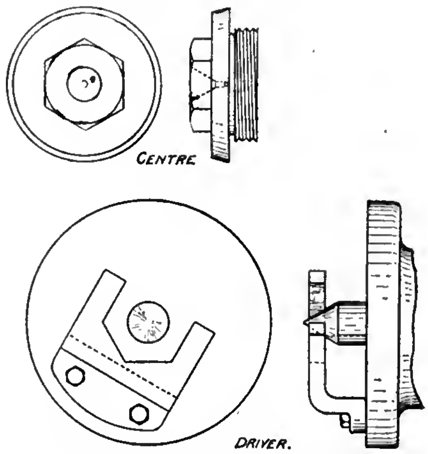


FIG. 20. TOOLS USED IN GRINDING OPERATIONS.

of machines similarly equipped to the one just described is installed, in which the nose grinder is also a Landis machine, and the body grinder a Norton machine.

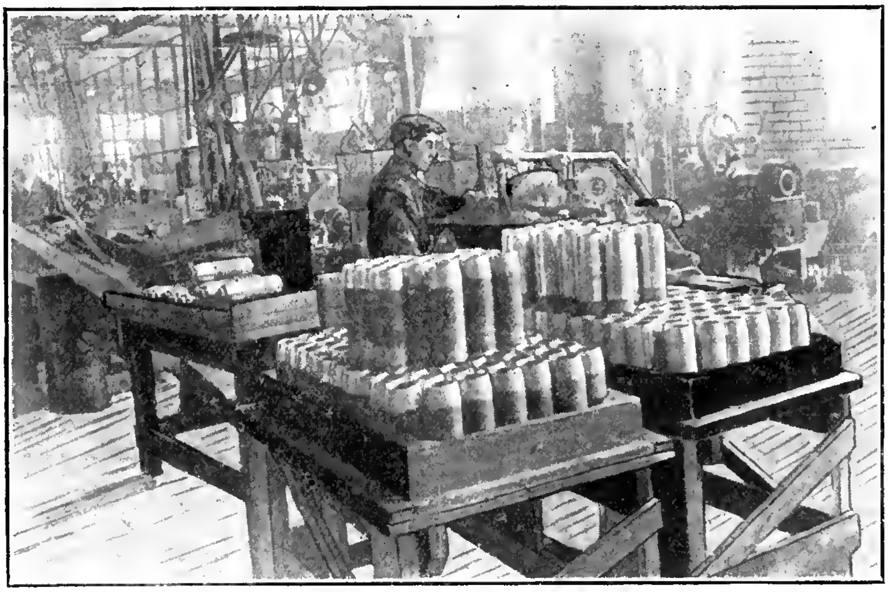


FIG. 21. GRINDING SHELL BODIES AND NOSES.

Pressing on the Copper Bands.

The shell now has the copper band slipped loosely over the base and into the recess, a blow from a wooden mallet being sufficient to hold the band in the recess. The band is then pressed on in the banding press, shown in Fig. 22. The press is operated by air, and was primarily constructed as an experiment, but, although more or less of a makeshift, it has done excellent work for many months. A crank has been fitted to a belt-driven counter-shaft, and through the medium of this crank the air valves are operated automatically. Should, however, it be advisable to stop the machine, it can be done simply standing on a foot lever, which throws the automatic valve gear mechanism out of commission; stepping off the lever throws the mechanism into commission again. Of course, a valve in the air line is also provided for long stops. This machine is capable of pressing on fourteen hundred bands in one day.

Turning the Copper Bands.

Three engine lathes are fitted up to turn the copper bands, the most interesting of these lathes being a London Machine Tool Co. product. This machine is equipped with an air chuck of the split collet type, and Fig. 23 shows the lathe. The shell is placed in the chuck and is located by a stop on the cross slide, and the roughing tool is carried in the standard tool-holder on the cross slide. The cross slide is moved up against a stop, the latter determining the depth to which the roughing tool shall be fed into the work. The finishing tool is carried on the vertical fixture mounted on the rear of the cross slide. This tool works in a vertical slide and shaves the band to size. Details of this tooling can be seen in Fig. 24. The other two lathes have not as yet been fitted up with air chucks, but, as soon as these can be made, they will be attached. The other lathes are—MacGregor, Gourlay & Co. and New Haven Mf'g. Co. products. These lathes are both fitted with collet chucks. Limit ring gauges are used to test the diameter of the band. From here the shells pass on to the assembling department.

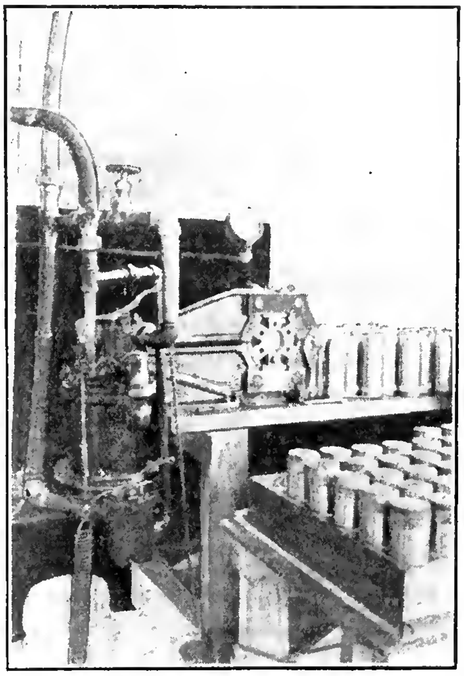
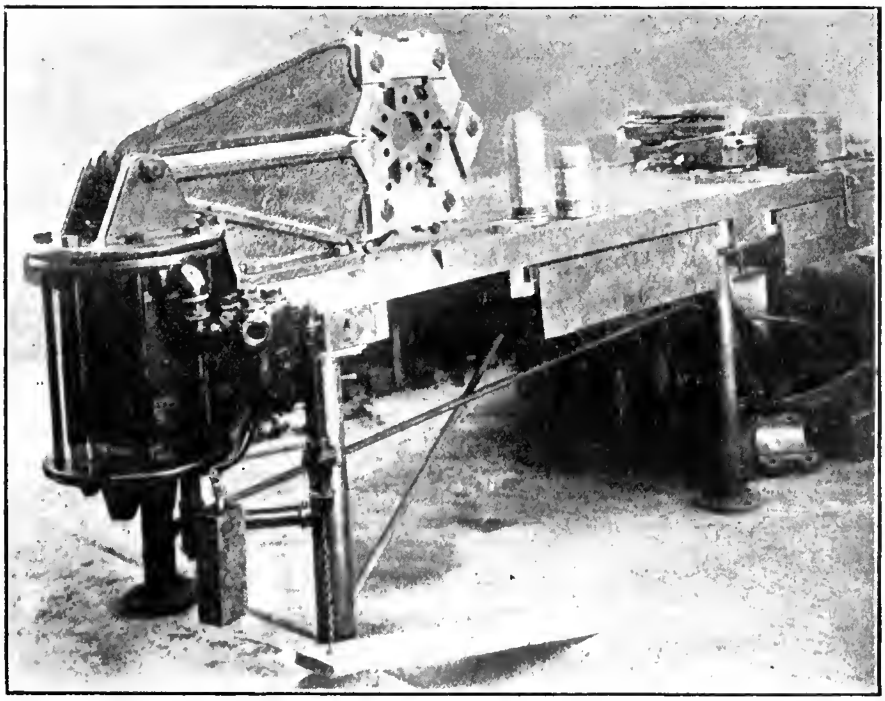


FIG. 22. BANDING PRESS.



CANADIAN INGERSOLL RAND CO. BANDING PRESS.

The first operation in the assembling department is the marking of the shells on a hand-operated Dwight Slate stamping machine, following which the powder cup and brass tube are put in. The shot is then poured in from a huge wooden container, a funnel being placed in the nose of the shell, which funnel holds the upper end of the powder tube central. The shell is placed on an air vibrator, which was removed from a moulding machine, the shot being thereby jarred and packed in. Molten resin is next run into the shell from one of three electric resin pots, after which the shell is carefully weighed on a delicate balance. A very narrow margin separates the limiting weights; therefore, small shot are added as necessary.

The shell is next clamped in a hinged chuck, and the brass socket screwed

home after its thread has been thoroughly coated with red lead. Pipe tongs are used for the purpose. The shell is then passed on to the solderers. Solder is cut in rings and placed over the protruding end of the powder tube, electric soldering irons being used in making the joint. This completes the work of the assembling department, of which Fig. 25 is a general view.

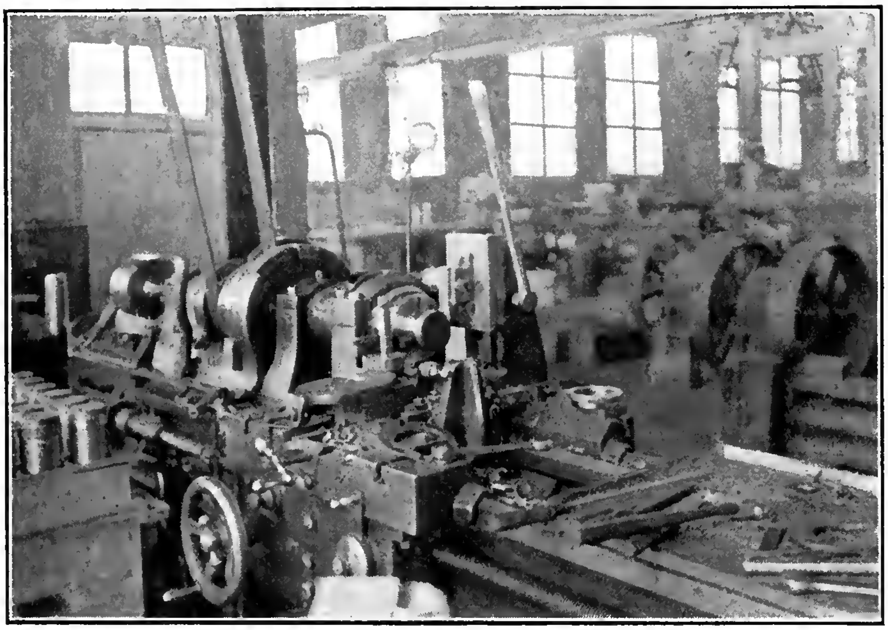


FIG. 23. TURNING COPPER BANDS ON A LONDON MACHINE TOOL CO. ENGINE LATHE.

Finishing Brass Sockets.

Three small lathes are fitted up to do this work. One is a Windsor Machine Co. turret lathe, one a Niles-Bement-Pond engine lathe, and the third is a Bertram turret lathe. The former machine, shown in Fig. 26, is equipped with an air chuck of the collet type. The tool for cleaning up the end of powder tube is carried on the turret, and the turning tools are carried on the cross slide. Some very ingenious stops are found on this machine, all of which tend to large production. A split collar is placed over the shell, so that when the collet jaws close they will come in contact with the split collar before the copper band is touched.

The Niles. Bement-Pond lathe is fitted with a special collet chuck, the details of which are shown in Fig. 27. The tooling on this lathe is somewhat out of the ordinary, all the tools being mounted on the cross slide. The tool for cleaning up the end of the powder tube is mounted on a fixture at the back of the cross slide, while the rough turning tool is on the central part of the cross slide and cuts from underneath. The finish turning tools are carried on the near side of the cross slide. The John Bertram lathe is tooled up with all tools on the turret.

Final Operations.

The shell now passes on to the final shop inspection. A sizing tap is run into the brass socket, and a rod is run down into the powder tube. All dirt is also blown out of the powder tin and tube by compressed air. Final Government inspection follows.

Painting.

After having passed the Government inspection, the shells pass on to the painting department. Fig. 29 shows the machine used for painting. The brass plugs are screwed in the sockets after the Government inspection and the square holes in these plugs are used to drive the shells in the paint machines, the outer ends being carried in revolving centres. The original machine was a bolt threader, built by the Webster & Perks Tool Co. The bases are painted with the shell resting nose downward in the block to the left of the machine. The shells are then placed in the machine and revolved, being thus horizontal when the bodies are painted.

A priming coat of black japan is applied to the shells, after which they are lifted from the machine by a special pair of tongs, which grasp them by the copper-driving band, which portion is not painted. The shells are now placed nose downward on the large drying shelves, which have recesses in them to accommodate the ends of the noses and cause the shell to stand in a vertical position. After being thoroughly dried, the final coat of paint is applied and the nose painted with red lead. This method of painting entails more or less handling of the shells and the engineering department have been endeavoring to devise a better method.

The first result of their work is seen in Fig. 28. A little sewing machine motor of $\frac{1}{8}$ h.p., built by the Holtzer Cabot Electric Co. of Boston and Chicago, is belt-connected to the cupped shaft, into which the nose is placed, and the shell is thus driven. The shell is inclined and the upper portion is supported by two rollers which bear against the copper-driving band. The whole is mounted on castors, and can be pushed along in front of the drying shelves and very little handling of the shells is necessary. A sufficiently long piece of

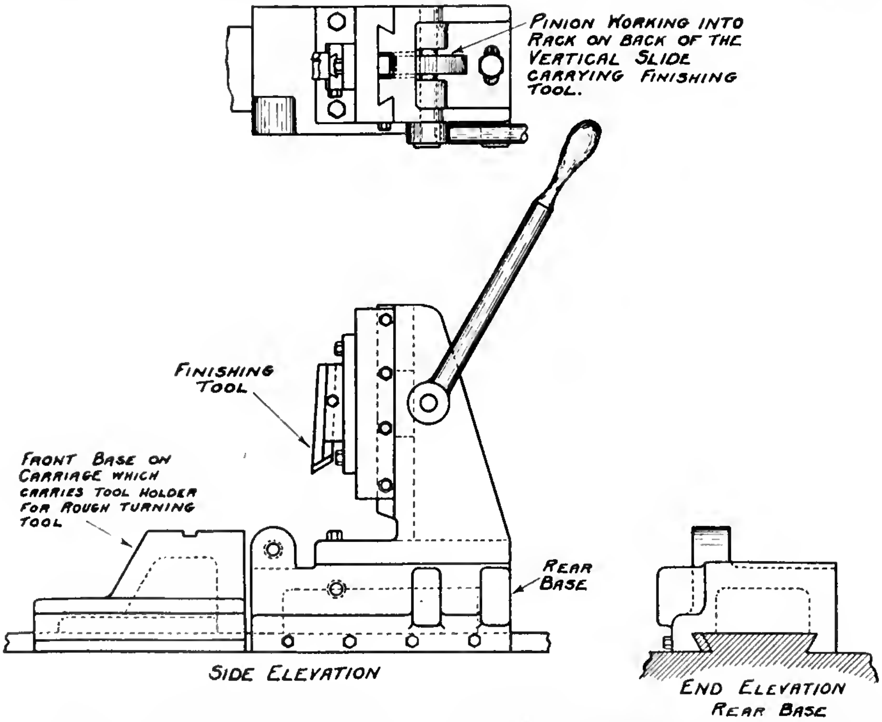


FIG. 24. DIAGRAM SHOWING METHOD OF FINISH TURNING THE COPPER BANDS.

lamp cord is furnished, and thus the machine can be used along the different rows of shelves. Experiments show the little apparatus to be very efficient, while at the same time the acme of simplicity.

After painting, the shells are placed in the drying racks by means of tongs grasping the copper bands or by hand. After being allowed to become thoroughly dry, they are packed in boxes of six and shipped.

General.

This shop is now turning out about fifteen hundred shells per day, but it is anticipated that this production will soon be increased to 2,000 shells per day, this being required in order to give the required delivery to the orders now in hand. All remuneration is made on a piecework basis where such is possible.

The lay-out of the shop is not ideal for shell making, because of the fact that the original lay-out for its peace time business purposes has been altered but little. Thus more trucking than would be required in a specially-designed plant is necessary. However, a large supply of Chapman Ball Bearing Co. and Cowan trucks are pressed into service and very little trouble or delay is experienced.

Compressed air is used freely on all machines to keep chips blown out of the chucks and from all moving parts. Loose scale and chips are removed from the shell itself by this method. Throughout the whole series of operations there does not appear to be one weak link; yet, in spite of that, the engineering department is steadily trying to improve on the various tools. Two shifts are worked—a day shift of ten hours and a night shift of thirteen hours.

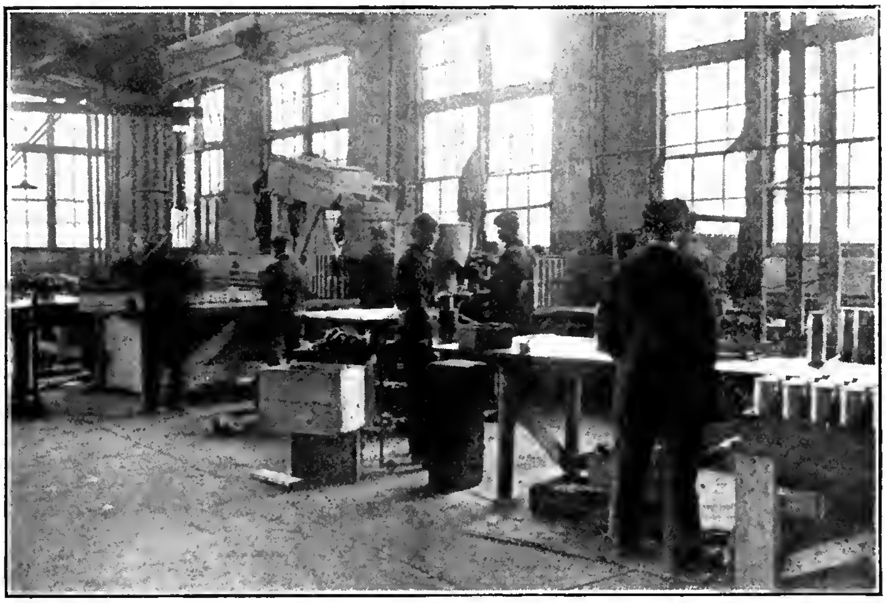


FIG. 25. SHELL ASSEMBLING DEPARTMENT.

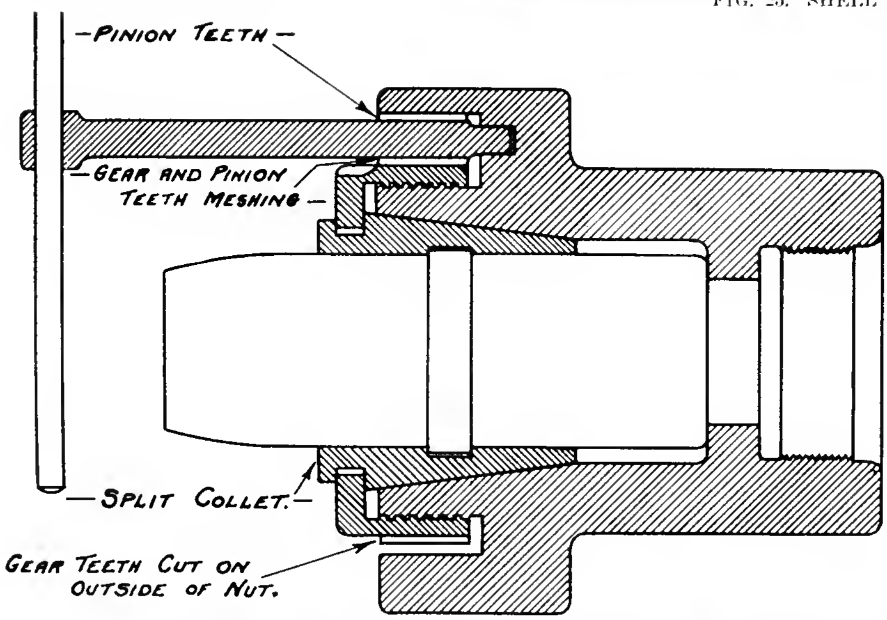


FIG. 27. SPECIAL COLLET CHUCK USED IN FINISHING SOCKETS.

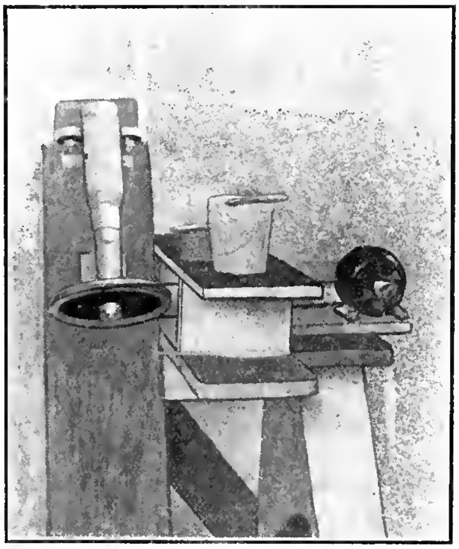


FIG. 28. PAINTING SHELLS ON A SPECIALLY CONSTRUCTED PORTABLE MACHINE.

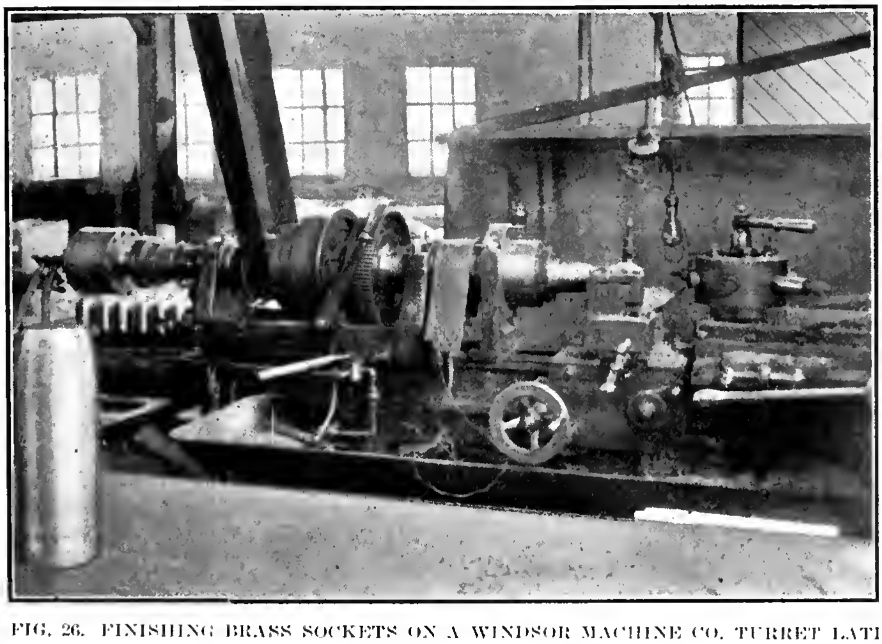


FIG. 26. FINISHING BRASS SOCKETS ON A WINDSOR MACHINE CO. TURRET LATHE.

The shop, to express in a nutshell the impression the writer received, is a "top-notcher" example of a modern industrial plant transformed quickly and at comparatively nominal expense into an arsenal. The quality of the work as well as the efficiency of the methods employed, will also compare favorably with a shop even primarily designed to manufacture this particular shell product.

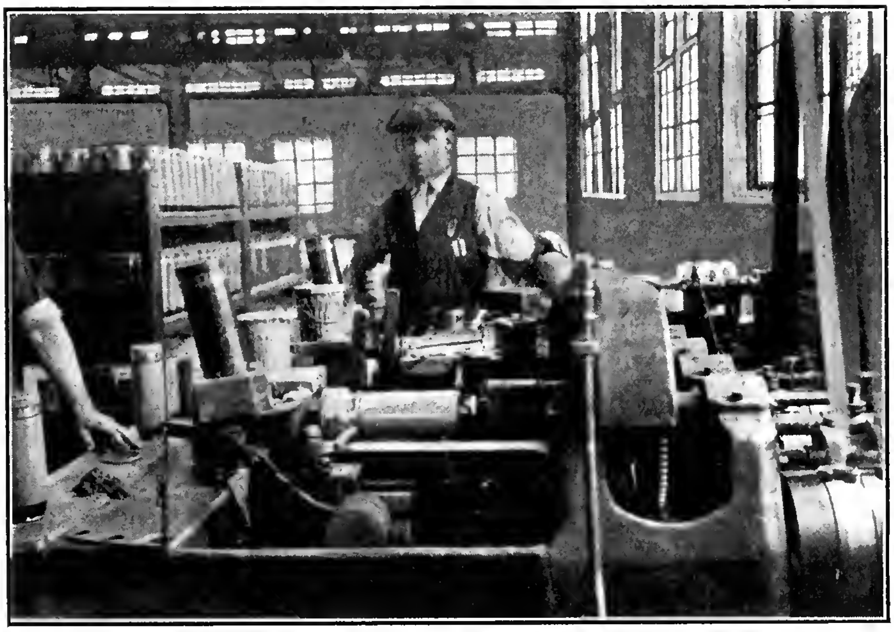


FIG. 29. PAINTING ON A STATIONARY MACHINE.

RANGE AND ACCURACY OF FIRE OF SHRAPNEL.

THE range of 3-in. shrapnel is from three to four miles, the velocity of tne shell decreasing as the flight proceeds. With a muzzle velocity of 1,700—2,000 ft. per second, flight at maximum range occupies twenty to twenty-five seconds. The velocity of the shell is then about 700—750 f.s., to which is added 250—300 f.s. bullet velocity when the bursting charge explodes. At two or three miles range, an average Q.F. 18 pdr. field gun places its shells within a zone about 200 ft. by 18 ft., and, adding to this the zone covered by the bullets, it will be seen that shrapnel gives tremendous sweeping action over a concentrated area.

Error Producing Factors.

Factors preventing absolute accuracy of fire include variable wind resistance and resistance of driving band, varying recoil jump, and slight variations in shell weight and balance. Each degree Fah. above or below 80 degs. increases or decreases the muzzle velocity about 2.5 f.s., so that fuses must be correspondingly shortened in hot weather. Considering the immense number of variables concerned, it is remarkable what accuracy of fire is actually attained.

Among the error-producing factors which are under control are eccentricity and weight of shell. On these very close limits are naturally placed, so that as little sacrifice as possible is made in the accuracy of fire. The specifications of different governments differ somewhat, but the outside and inside diameters of the shell have generally to be concentric within two mils; the weight variation in bullets may not exceed 1 drm. (1.8 grms.) per lb., the permissible variation from standard weight of the filled case being plus or minus 1 drm. (adjusted by the matrix), and the completed shell, ready for its fuse, must be within 4 grms. (2¼ drms.) of standard weight.

To attain such perfection of result in complex products to be used by the tens, or even hundreds of thousands per day, demands the greatest possible care in the manufacture of every component part, and requires an organization, sustained effort, and performance of which our shops, machines, and our operatives are proving themselves thoroughly capable. In the abstract, the wastage of material, labor, and time involved is appalling, but if the price of victory be not paid swiftly and ungrudgingly, we are condemned to the far more frightful penalty of defeat, in yet greater losses of life and treasure, and in ultimate national destruction.—Engineering Review.

BREATHING PROVISION IN SUBMARINES.

THE personnel of a submarine depend for air for breathing purposes while submerged on the free air in the boat at the time of submerging and the compressed air carried in storage flasks, which is used in freeing ballast tanks of water as well as for breathing. In the average submarine in commission today, the air contained in the boat at the time of submerging is sufficient to last officers and crew, numbering 18 men, for a period of from 9 to 12 hours.

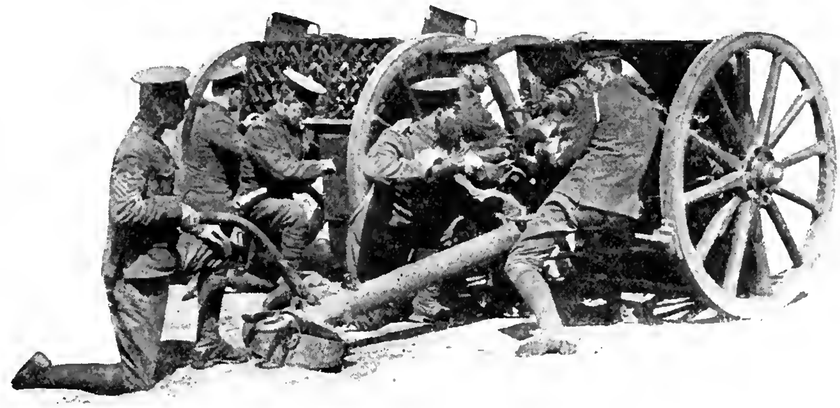
The air carried in the storage flasks is about sufficient to replenish the entire volume of air in the boat twice at atmospheric pressure, provided it is used for no other purpose. The maximum time during which all the air available can be breathed without serious effect is, therefore, from 30 to 36 hours. In computing this time, the safe amount of CO_2 that should be allowed to accumulate in the air at any time is taken at 2 per cent. Men vary, however, in their ability to withstand the effects of CO_2, the average man being able to withstand about 2½ per cent., while an exceptionally strong man can withstand as much as 5 per cent. Therefore, the time during which life can be sustained by the air in a given boat will depend somewhat upon the powers of resistance to the effects of CO_2 on the part of the personnel.

The air is maintained in condition for breathing by two methods:—First, by slowing bleeding from the main air supply into the boat and pumping air out very slowly; and, second, by allowing the air to become foul and then pumping a part of it out of the boat and replenishing it from the air flasks, at the same time maintaining a normal atmospheric pressure in the boat. The former method has been found more economical of air. The air in the boat is kept in circulation, as it has been demonstrated by experiment that air in circulation may be charged with a much greater percentage of CO_2 than still air without evil effect on the person breathing it.

SUBMARINE EFFECTIVENESS DUE TO THE TORPEDO.

THE principal offensive weapon of the submarine is the torpedo, an extremely intricate mechanism built along the lines of the submarine itself, but automatic in its action after leaving the tube from which it is fired. The torpedo is divided into four main parts—the head, air flask, afterbody, and tail. The head contains the explosive and the mechanisms to fire it. Abaft the head is the air flask. This contains the compressed air for the propelling machinery.

In the next division of the torpedo is found the depth-controlling mechanism, the air superheater, the main propelling engines, the steering engines and gyroscope, and the shafting to the propellers, as well as the rods to the rudders. The tail inside contains the gear wheels for the propellers, while on the outside are the supporting parts for the propellers, the diving rudders and the vertical rudders.



Impromptu Production of Shrapnel Shell Forgings

Staff Article

The development of our shrapnel shell industry, more especially on account of the widespread distribution of contracts among our machine shops, has of necessity increased the demand for shell forgings. The forging plant here described has been improvised accordingly, and, as will be noted, is adding a substantial quota to the meantime need. In the next few weeks, it will, however, give place to a special purpose shell forging installation.

TOWARD the latter part of last winter, the forging capacity of our Canadian shops was well below the machining capacity as far as the 18-pdr. shrapnel shell was concerned. This condition of affairs induced many firms specializing more or less in boiler-making, to investigate the feasibility of installing presses for turning out shrapnel forgings. The operations all look simple enough to the casual observer, but to one familiar with punch and die practice, the job really conveys to him the fact that there is a great deal of work connected with the proper designing and machining of shell-making punches and dies.

The steel arrives in the shop in the shape of round bar stock 3½ in. in diameter. These bars are placed in cutting-off machines and cut into billets 4 13-16 inches long. Four machines are employed in this operation, one being an Acme Machinery Co., Cleveland, Ohio, product, and the three others of John H. Hall & Co., Brantford, make. Fig. 1 shows the "Acme" machine at work. On each of the four machines two tools are used to cut off the bar. The bars are moved forward against a stop in each instance when a new cut is about to be started; thus the length of the billet to be cut off is automatically measured. Each machine is fitted with a universal chuck having four jaws.

Small nibs are left on the ends of the billets as they come from the cutting-off machines, and these are removed on a slotter manufactured by Smith, Beacock & Tannett of Leeds, England. The billets in the jig provided for this purpose are clearly shown in Fig. 2.

The billets are next carried to the furnace in which they are heated previous to the first forging operation known as piercing. This furnace is clearly shown in Fig. 3, and is a "Ferguson" product equipped with oil burners. Fig. 3 shows that side of the furnace on which the billets are fed in, three doors each equipped with counterweights being there installed.

The billets are placed in the furnace in a simple, yet rather unique way. A large piece of flat iron is laid on one of the projecting ledges in front of the doors. This flat iron is shaped like a paddle with a long blade, and a handle which makes it an easy matter to turn it on edge, is fitted to the end. Eight billets are placed on the blade of the

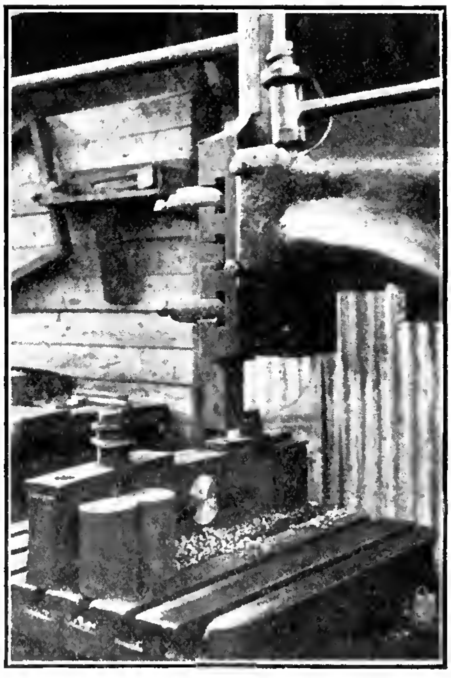


FIG. 2. SMITH, BEACOCK & TANNER SLOTTER FITTED UP TO REMOVE NIBS FROM ENDS OF BILLETS.

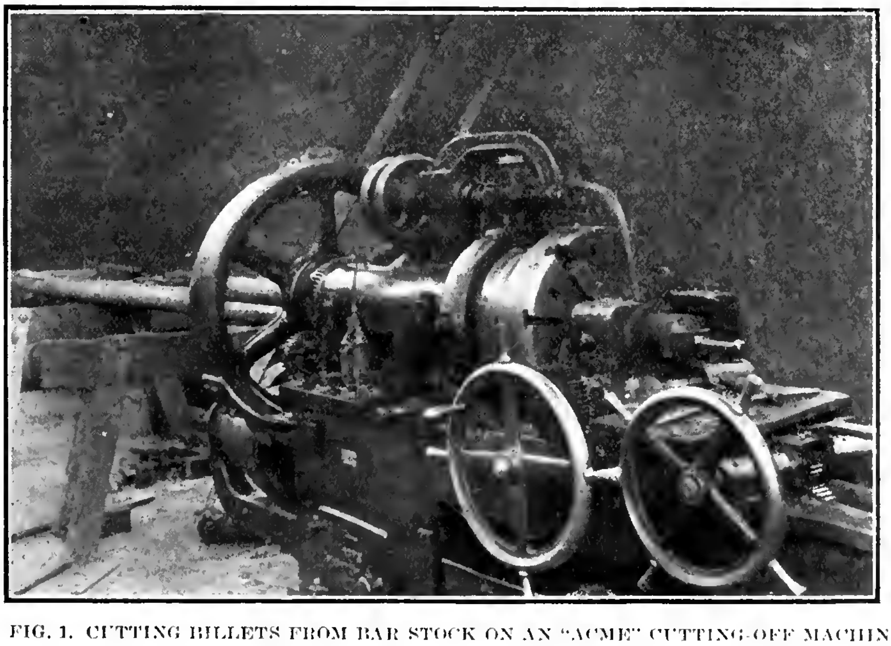


FIG. 1. CUTTING BILLETS FROM BAR STOCK ON AN "ACME" CUTTING-OFF MACHINE.

iron and the door is opened. The iron slab is pushed into the furnace and turned on edge, leaving the billets on their sides, in rows of eight in the muffle

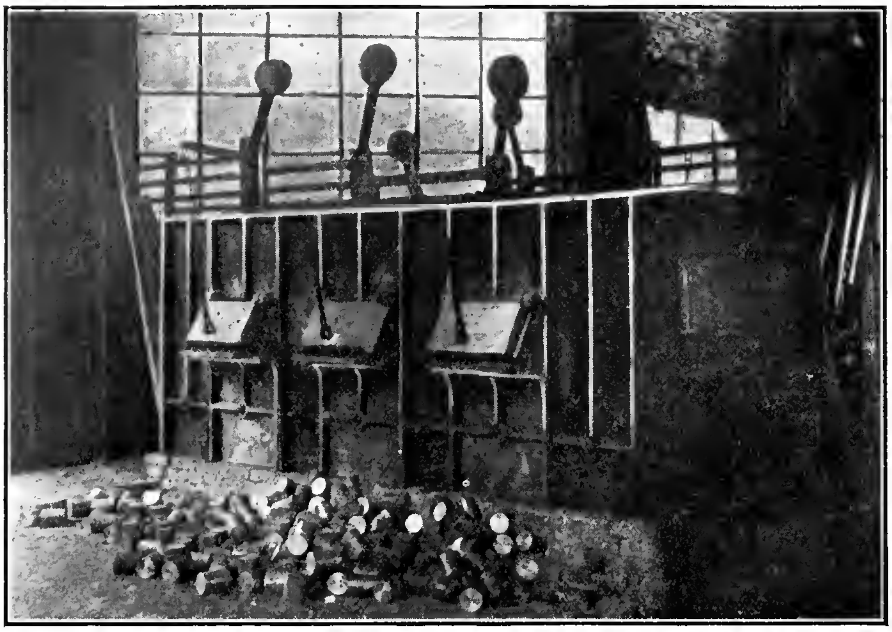


FIG. 3. OIL FURNACE FOR HEATING BILLETS PREVIOUS TO PIERCING OR FIRST OPERATION.

of the furnace. The heated billets are removed from the other side of the furnace by the three doors provided for that purpose. The billets are heated up to 1900° F. or 2000° F., and are left in the furnace for no stated length of time, being removed as required by the presses.

Piercing Operation.

The piercing operation is accomplished on an R. D. Wood hydraulic press of 350 tons capacity. The hot billets are removed from the furnace and picked up

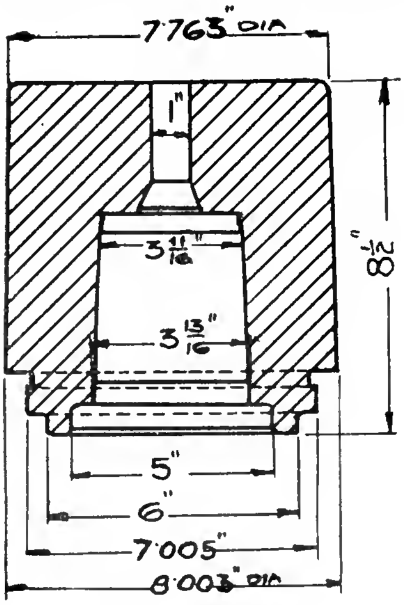
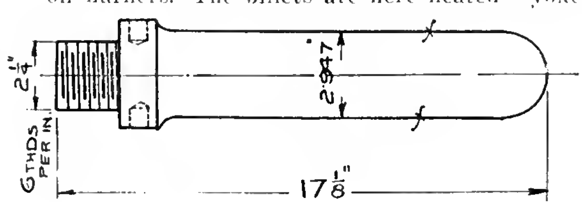


FIG. 4. PIERCING DIE.

with tongs. The billets are knocked on an iron block to remove any loose scale and are placed in the dies shown in Fig. 4. The punch is shown in Fig. 5. The centering tool which guides the punch and causes it to strike the billet centrally, is shown in Fig. 6. The billet is elongated through this operation from 4 13-16 inches to about 7 inches. This press is equipped with a single spindle and is shown in Fig. 7. The billet heating furnace is seen immediately behind the press.

Reheating Furnace and Drawing Operation.

The billet is taken from the 350-ton press and passed on to the reheating furnace, shown in Fig. 8. This furnace was built by the Canadian Locomotive Co., Kingston, Ont., and is fitted with oil burners. The billets are here heated



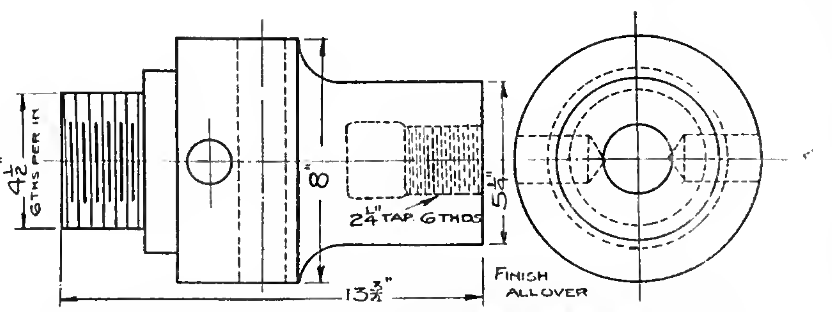


FIG. 5. FIRST OPERATION OR PIERCING PUNCH, AND HOLDER FOR SAME.

up to about 1900° F. or 2000° F. again, preparatory to being drawn out to finished length. After being heated, they are taken to the 200-ton R. D. Wood two-spindle hydraulic press for the final drawing operations. This press is shown in Fig. 9. Two quite distinct operations are performed on the press. The first is the bottom forming. The press is only allowed to complete a portion of its stroke. The punches come down in the pierced billet and the billet or forging is brought up against a bottoming die which forms the base of the forging on both the interior and exterior of the shell. This bottoming die is shown in

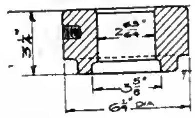


FIG. 6. CENTERING TOOL FOR GUIDING PIERCING PUNCH WHEN LATTER IS ABOUT TO PIERCE BILLET.

Fig. 10. It has still another function to perform. It stamps on the base of the shell the letter of identification belonging to the firm and the number corresponding to the carbon content of the steel. The stroke of the press is automatically stopped at the point when the punch and die have properly performed their operations. The die is placed in a small portable die holder and when the press is reversed this die and die holder are removed by means of a handle conveniently attached. The die and die holder appear in Fig. 9 on the floor in front of the press.

On the next stroke of the press, the forging which has risen with the punch is forced through the drawing dies of which there are three, the details being shown in Fig. 11. The punch details are shown in Fig. 12. The forging after being forced through the three drawing dies is stripped from the punch by a yoke of iron which is thrust into the die holder below the dies. Thus, the forging operations are completed. The forgings are piled up behind the press and are allowed to cool in the air.

The punches are in contact with the hot forgings for so long a period that they naturally become very warm. In order to cool them, water is played on the punches, being conveyed to them through a hose and through the medium of a cylindrical piece of iron. After cooling, the punches are coated liberally with a thick

mixture of black oil and graphite. The dies are also coated. This mixture is also used on the piercing press punch and dies.

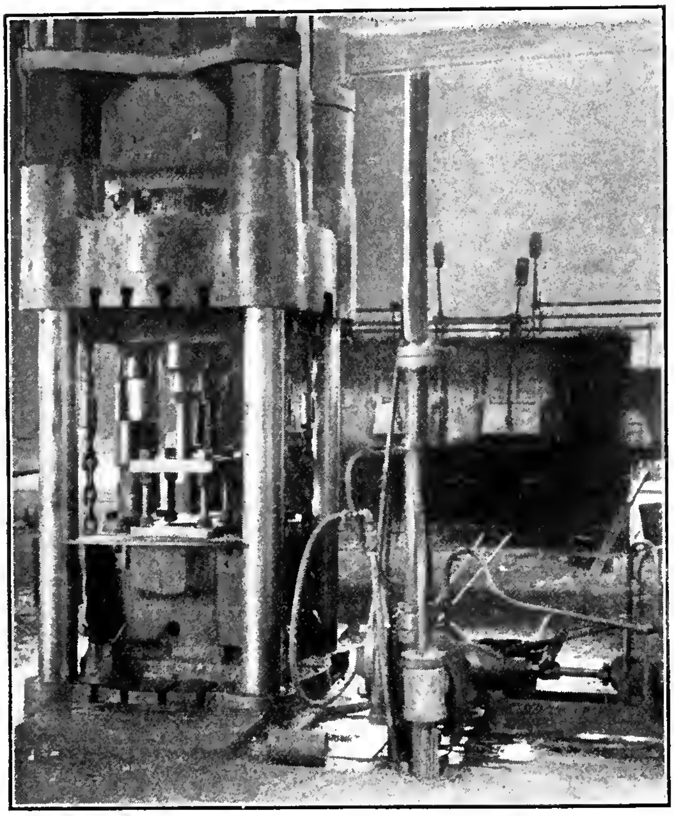


FIG. 7. R. D. WOOD 300-TON PRESS FITTED UP FOR PIERCING BILLETS.

Hydraulic Pressure Pump and Accumulator.

The presses are operated under a pressure of 1,500 pounds per square inch. The pump is a product of the Snow Steam Pump Co. of Buffalo, N.Y. At present the company are somewhat handicapped because they have had to equip so quickly all their various features. As soon, however, as delivery can be made, a new pump and accumulator of much larger capacity will be installed. Fig. 13 shows the present pump and accumulator which are working under a heavy over-load constantly.

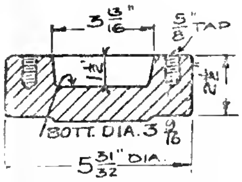
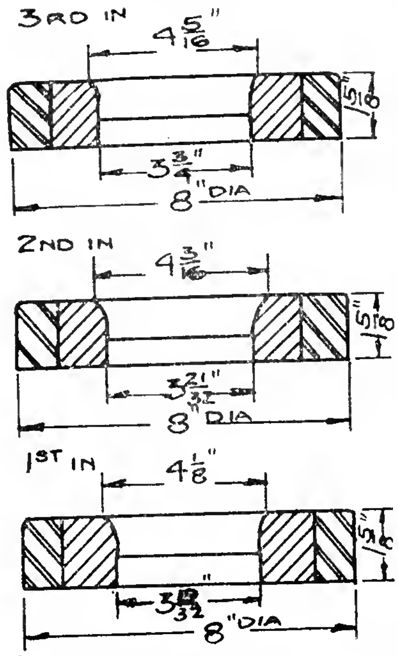


FIG. 10. BOTTOMING DIE OF 200-TON "WOOD" PRESS.

Annealing.

After coming from the drawing press the forgings are annealed. This is done in the large Ferguson oil furnace which is installed. The shells are placed in the furnace for a period of about one hour and are kept at a temperature of 1200° F. Several hundred shells can be annealed at one time in this large furnace. The shells are afterwards removed and



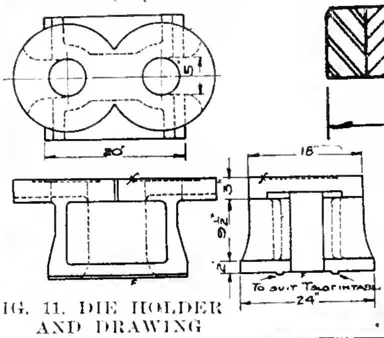
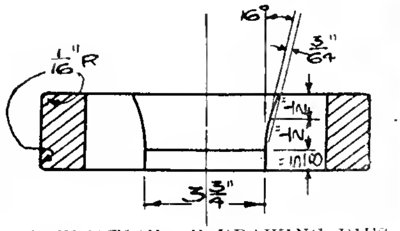


FIG. 11. DIE HOLDER AND DRAWING DIES.



MODIFICATION OF DRAWING DIES.

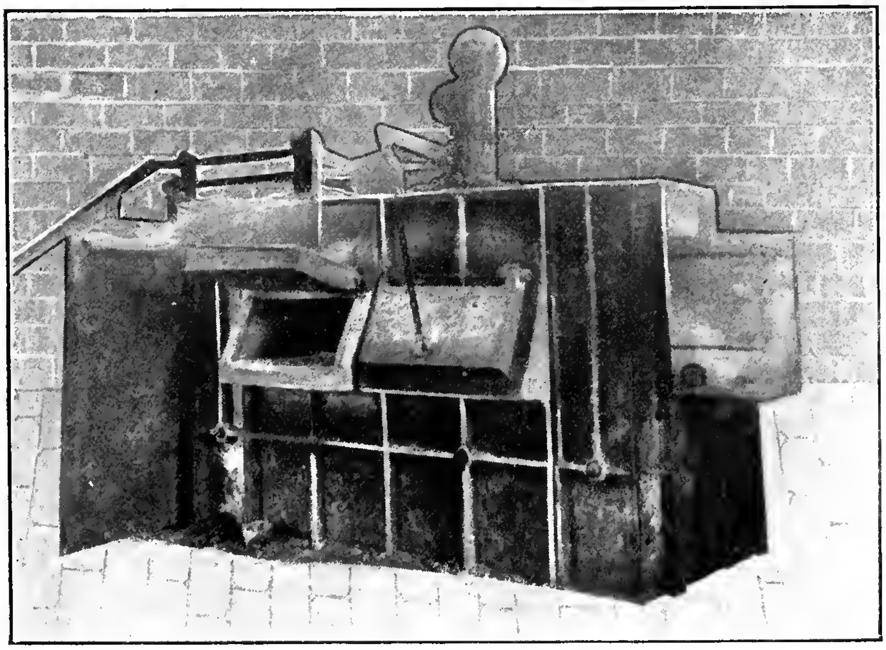


FIG. 8. REHEATING FURNACE.

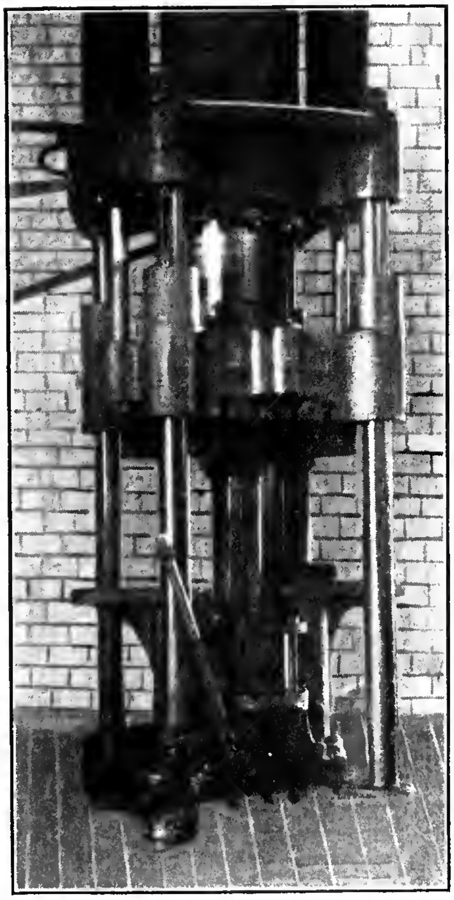


FIG. 9. R. D. WOOD CO. 200-TON HYDRAULIC PRESS ON WHICH THE DRAWING OPERATIONS ARE PERFORMED.

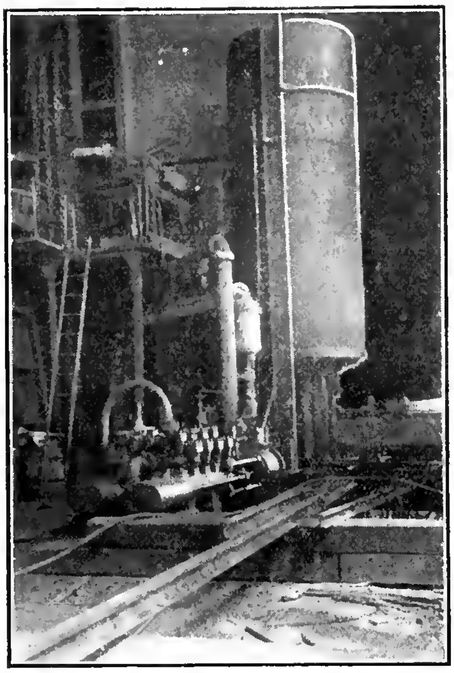


FIG. 13. SNOW STEAM PUMP AND ACCUMULATOR DELIVERING WATER TO HIGH PRESSURE MAINS AT 1,500 LBS. PER SQ. INCH.

allowed to cool slowly in the air. The heavy doors of the furnace are opened and closed by compressed air means, which makes their operation an extremely simple matter. The shells next pass on to the Government Inspection Department.

Government Inspection.

The forgings are inspected by a corps of Government Inspectors, and Fig. 14 shows them at work. The inspection can be divided into six operations.

The first operation is to stand the forgings all on end and with a portable incandescent lamp, to which is fitted a reflector, examine carefully the interior of the shell forgings for scale.

The second operation is to test the thickness and the uniformity of the walls. In Fig. 15 at A the gauge used is shown. This gauge simply calipers the walls, and the thickness is read from the gradnations above.

The third operation is to test the inside diameter. A pair of inside calipers

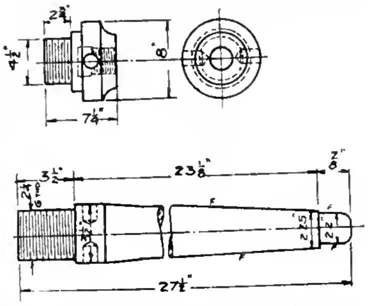


FIG. 12. DETAILS OF PUNCH AND HOLDER IN DRAWING OPERATION.

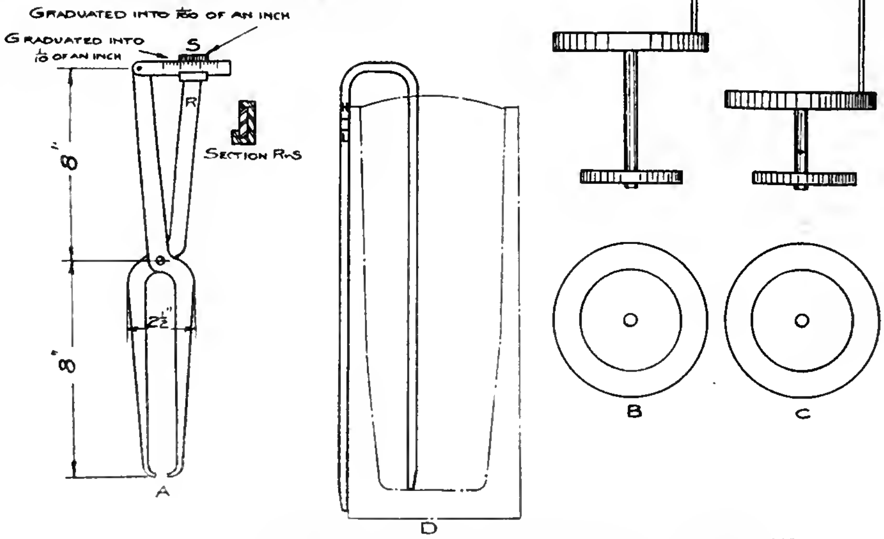


FIG. 15. GAUGES USED IN THE GOVERNMENT INSPECTION.

of more or less special design is used. The gauges B and C in Fig. 15 are placed in the forging and the diameters at these levels are tested. The gauge B brings the calipers to the top of that portion of the shell which is not machined when the shell is completed. Similarly the gauge C brings the calipers to the low level of the unfinished diameter.

The fourth operation tests the length of the shell, the gauge at D in Fig. 15 being used for this purpose. The high and low limits of length are shown on the gauge and the end of the gauge outside the forging shows if there is the required amount of metal in the base of the forging.

The fifth operation is to test the outside diameter of the forging with a snap gauge, and while doing this the inspector glances down the forging to see if it has become warped or not. It may be the right outside diameter, but if it is not straight it is not a perfect forging, so must be rejected.

The sixth and final operation of the inspectors is to mark the shell forging.

General.

Responding to the call for more forgings, this company has thrown itself into the work with the greatest of enthusiasm. The above installation shows what can be accomplished on short notice, and from this plant there are being daily received more than 2,700 forgings. By the time that this article appears in print much of the new equipment will have been received and the plant will present an entirely different appearance and will have a greatly increased capacity. However, the above description is interesting from the fact that but little of the installation was new, existing equipment being improvised by the inventive genius of the mechanical department.

FIG. 14. GOVERNMENT INSPECTORS AT WORK ON 18-PDR. SHRAPNEL FORGINGS.

CONTEMPORARY WAR ARTICLES

Embracing Information and Data Drawn from a Variety of Sources Relative to and Arising from the Prosecution of this Many-Sided European War

HIGH EXPLOSIVES.*

By L. S. Marsh.

IT is here endeavored to give briefly the methods of manufacture, uses, and, to a slight extent, the historical side of the more important explosives.

Gunpowder Discovery.

While gunpowder or ordinary black powder is not generally classified with the modern high explosives, its discovery and development have been of so much importance in the general development of all explosives that a little time may be profitably devoted to it. Black powder was probably discovered by accident, and Friar Bacon, to whom is generally ascribed the discovery, did not, therefore, really invent gunpowder.

It seems certain from such information as we have at our disposal that Friar Bacon about the year 1250 had mixed up an experimental compound of some kind, the ingredients of which among others were saltpetre and sulphur. We can imagine the effect of igniting such a mixture and if, perchance, the good Friar had rubbed some of the mixture in a mortar it is safe to assume that he was surprised at the results obtained by this simple though dangerous operation. Roger Bacon undoubtedly fulfilled the prophecy of Prometheus that, "in the latter day, a wondrous being would appear who should call forth flashes brighter than lightning and sounds louder than thunder."

Other Explosives.

Gunpowder was for years called "kraut" in Germany, and in view of its present use the other part of the word might well be added. For 500 years gunpowder remained the only explosive, and not until the year 1846 did there appear anything really new in the line of explosives. In this year Schoenbein discovered nitro-cellulose, the basis of all smokeless powders, as well as of many modern products whose uses are more in the realm of peace than of war. In the year 1799 mercury fulminate was discovered by Howard, the use of which, however, as a filler for percussion caps was not commenced until 1815. The next important step in the development of explosives was the discovery by Sobrero in the year 1847 of that exceedingly important and highly explosive compound, nitro-glycerine. Little use was made of nitro-glycerine until the invention of dynamite because of the fact that nitro-glycerine could not be handled and transported in the liquid state without very great danger. The first practical use of nitro-glycerine was made during the construction of the Hoosac Tunnel, the nitro-glycerine being transported to the work in a frozen condition.

In 1875 Nobel discovered that an explosive composed of a mixture of collodion cotton and ordinary dynamite gave greatly increased results on explosion, this same investigator having discovered dynamite as we ordinarily understand the term, in the year 1867. Blasting gelatine, discovered by Nobel in 1875, and referred to above as the mixture of collodion cotton and dynamite, is probably the most powerful explosive, weight for weight, at the present time, at least which can be used in any practical manner. Blasting gelatine owes its great explosive power to the fact that the excess of oxygen in the products of explosion of nitro-glycerine supplies the deficiency in explosion of nitro-cellulose, the carbon burning to carbon dioxide instead of partly to carbon monoxide, which additional chemical action results in the production of more heat and therefore greater volume of gas, and greatly increased force of explosion.

Divisional Classification of Explosives.

There are two general divisions in the classification of explosives, namely, explosive mixtures and explosive compounds. Explosive compounds are mechanical mixtures containing various ingredients in the form of grains of finely pulverized material, these ingredients supplying a combustible and an oxygen carrier. As an example of an explosive mixture, gunpowder is the first one which comes to mind, and is to all intents and purposes the most important of all explosive mixtures.

Explosive compounds are those substances which contain within the individual molecule the necessary substances or elements to produce an explosive wave when detonated or otherwise broken up. As an example of an explosive compound we may refer to many of the hydro-carbons and compounds of organic origin, such as the nitro compounds of ether, acetone, phenol, glycerine, cellulose, and a large number of other organic compounds.

Black Gunpowder.

Black gunpowder is one of the most common, and, from a practical standpoint, one of the most important, of all explosives, and its manufacture, while not without danger, is, however, less liable to cause trouble in the process of combining the various ingredients than some of our other forms of explosives. Black powder, as generally made, consists of potassium nitrate 75 parts, carbon in the form of charcoal 15 parts, and sulphur 10 parts. The first requisite in the manufacture of black powder is to obtain strictly pure materials, then the proper grinding and mixing of the three ingredients named above. The potassium nitrate supplies the oxygen necessary for the combustion of the carbon.

Gunpowder Manufacture.

In the manufacture of gunpowder the materials are first ground, then sifted into grains of various sizes, after which the materials are weighed out in 50-lb. lots. The mixing of these ingredients is accomplished by means of a rotating drum which is supplied with paddles travelling in an opposite direction to that of the drum itself. After the materials are thoroughly mixed in this manner they are taken to the incorporating mill which resembles the ordinary edge runner largely used in some of our older cement mills for the purpose of grinding slurry. The rollers of the incorporating mill weigh about 4 tons apiece, and the charge of mixed materials is placed on the bed of the mill to a definite depth made necessary by the fact that if the layer is less than one-fourth of an inch thick there is great danger of explosion, while if greater than one-half inch in thickness the incorporation of the ingredients will not be satisfactory.

The process of incorporating usually requires from three to four hours, and the product is known as mill cake, which is broken up into lumps of uniform size by machinery especially designed for this purpose. These lumps or particles are now made into press cake by means of hydraulic presses to further insure the complete homogeneity of the product, the press cake being again broken up and passed through sieves of different size mesh in order to produce powder grains of various sizes. The size of the powder grain is of great importance, as, upon the size of the grain depends the rapidity of combustion, and, therefore, the shattering effect of the explosion.

Gun Cotton.

Probably the most important explosive of modern times is gun cotton, this being largely used for filling shells and mines used in modern warfare. Gun cotton is probably the most easily handled

*From a paper read before the Western Society of Engineers.

and safest of all our modern explosives. In order to gain an idea of the manufacture and composition of gun cotton we must start with the substance called cellulose. Cellulose is the skeleton left of the vegetable tissue after the substances whose functions rest entirely with the vital processes of the plant have been removed by chemical treatment. The rate of propagation of the explosion in gun cotton is somewhere between 17,000 and 21,000 feet per second.

Gun Cotton Manufacture.

In the manufacture of gun cotton, old rags and waste from cotton spinning mills are generally used, which require very careful cleansing and drying before being subjected to the nitrating process. The cleansing is accomplished by treating the cotton with a strong solution of caustic potash and then washing with running water until all traces of the caustic are removed. The material thus prepared is dried and then weighed out in batches of 16 lbs. each, and placed in the nitrating machine. The nitrating machine resembles somewhat the ordinary centrifugal used in the sugar mills, and is so arranged that the acids used in nitrating may be rapidly removed and water allowed to run in, in order to commence the washing at the very earliest possible moment after the action of the acids has been completed.

During the process of nitration, the cotton increases greatly in bulk and weight, the 16 lbs. weighing, when nitrated, about 25 lbs. In order to remove all traces of acids from the nitrated cotton, washing is continued for several hours in running water, after which the nitrated cotton goes to the hydraulic press for the removal of excess water. If the gun cotton is to be stored for any great length of time, about 40 per cent. of water is left in it in order that there may be no possibility of accidental explosion, as wet gun cotton is perfectly safe under all ordinary conditions. Our modern smokeless powders are made by treating cotton in such a way as to produce what are known as colloids.

After cotton fibre has been treated with nitric acid and sulphuric acids, as in the process of nitration, it possesses a property which it did not have before nitration, and that is its solubility in certain substances, most important of which are acetone and a mixture of alcohol and ether. Gun cotton dissolved in these solvents will give a light amber-colored solution which, upon evaporation, will yield solids more or less viscous in their nature, the viscosity depending upon the amount of solvent left in the mixture. This resulting compound is called a colloid, and is the substance used in the manufacture of smokeless powder.

Smokeless Powder.

In the practical manufacture, on a large scale, of smokeless powders, nitrated cotton is run through a machine which shreds it into small particles very much resembling paper pulp as in the process of paper manufacture. Chemical control is maintained during the process of shredding and washing in order to ascertain the presence of free acids in the mass. Gun cotton must not be permitted to retain any of the acids used in the process of nitration as they would cause decomposition and consequent accidental explosion. After the gun cotton has been thoroughly shredded and resembles bread dough, it is placed in what is called a stuff chest, in the interior of which revolves an endless screw which forces the cotton out through an opening at the top.

The gun cotton as it is now prepared contains about 40 per cent. of water, and in order to remove this excess water and prepare the cotton for the colloiding process it is put through a hydraulic press and a large part of the water removed by pressure. The pressure cannot be continued sufficiently, however, to remove all the water, and alcohol is permitted to run through the top of the cylinder containing the cotton, thus taking out all of the water by solution in alcohol. Practically all of the alcohol is pressed out of the cotton, which then goes to another press and is treated with ether, thus completing the process of collodization.

The colloided cotton is passed through dies by means of an endless screw revolving in the drum, these dies being arranged with needles which give perforations in the resulting rope or rod of smokeless powder. These rods are of various diameters and are cut into sections or grains by means of bronze knives. As in the case of ordinary gunpowder, the size of the grain determines the rapidity of combustion, and, for large calibre guns, smokeless powder may be made in the form of sticks resembling walking-canes.

Nitro-Glycerine.

The manufacture of nitro-glycerine is very similar to that of gun cotton, with the exception that the substance to be nitrated is glycerine in the place of cellulose. Nitric and sulphuric acids are used for nitrating glycerine, but a very careful watch has to be kept of the process in order to prevent the occurrence of disastrous explosions due to the decomposition of the glycerine and consequent rise in temperature of the mixture. The nitrating of glycerine usually requires about one-half hour, after which the treated glycerine is run into tanks filled with water, where it sinks to the bottom, and is drawn off for further purification.

Nitro-glycerine, as such, is not used to any great extent at the present time, but is the basis of a large majority of the dynamites now on the market. Ordinary dynamite consists of some absorbent material, such as infusorial earth, otherwise known as Kieselguhr, which is permitted to absorb the nitro-glycerine, the amount of this absorption depending upon the strength of the dynamite desired. Dynamites are graded according to the percentage of nitro-glycerine which they contain, as, for example, 60 per cent. dynamite contains 60 per cent. by weight of nitro-glycerine. Some of the modern dynamites contain, in addition to nitro-glycerine, other substances which supply an excess of oxygen and thus increase the violence of the explosion.

Blasting Gelatine.

I have already mentioned the discovery of blasting gelatine, and would briefly state here that blasting gelatine consists of about 90 per cent. nitro-glycerine and 10 per cent. nitro-cellulose, the two substances being mixed by means of wooden paddles in a large tank or vat, and finally kneaded with the hands like bread dough until a mass, having a smooth, even consistency, is obtained, the resulting product resembling a jelly-like substance, soft enough to be easily cut with a knife. This mass is forced through a die as in the manufacture of smokeless powder, and the rope or cable is cut by means of a bronze knife into the desired lengths and wrapped in paraffin paper to form the completed dynamite stick.

ROYALTY AND THE RIVETER.

THE following humorous incident falls to be recorded in connection with the recent tour of inspection of our King among the Clyde shipbuilding and engineering establishments. At a particular yard the foremen were being presented, and when it came to the foreman riveter's turn, the introduction was effected in the following words:—"The foreman riveter, your Majesty, who controls the men giving most trouble at present in the shipyard." The King, with that kindliness which so won the hearts of the war workers, remarked "And I suppose you are having a rather difficult time in controllling your men just now." The foreman's reply was certainly convincing, if somewhat unexpected: "If yer Majesty had the handlin' o' them for a week ye wad ken something about it."

Lord Dewar, speaking at a recruiting meeting in Edinburgh, recently said that in the creation of her war machine, Germany had destroyed the soul of her people—a high price to pay, even for efficiency.

EDITORIAL CORRESPONDENCE

Embracing the Further Discussion of Previously Published Articles, Inquiries for General Information, Observations and Suggestions. Your Co-operation is Invited

RECRUITING OUR MECHANICS FOR BRITAIN.

MORE or less interest has been aroused and not a few misgivings have been expressed relative to the recruiting and enlistment of our skilled mechanics for war munitions manufacture in Great Britain. In order to get the pulse of the situation thus created, and therefore keep our readers in close touch with the present and probable future outlook development, we have been in communication with a large number of our engineering and metal-working plants, all of which are engaged in shell manufacture. Such of the replies to our letter as came to hand before this issue went to press are appended herewith:

Editor Canadian Machinery,
Toronto.

Dear Sir:

In answer to your favor of the 24th ult., we think it is a mistake to encourage the transportation of skilled machinists from Canada to Great Britain to work on war munitions there. Owing to so many manufacturing plants in Canada being engaged in manufacturing war munitions, there is at the present time a decided scarcity of skilled machinists in Canada, and the policy, therefore, of taking any of them away and transporting them to Britain is, in our opinion, entirely wrong.

We do not see what advantage is to be gained by simply transferring machinists from working on war munitions in Canada to Great Britain to do the work there. We need the men here and the only possibility of the Canadian manufacturers being able to increase their output as the British Government desires is to retain all the skilled labor we have, and, in addition, to train a great many who are at present unskilled. We think the Government should be strongly urged to invite the co-operation of the British Government to stop the transportation of skilled machinists from Canada.

Yours very truly,

——————

* * *

Canadian Machinery and Mfg. News,
Toronto.

Gentlemen:

Replying to yours of June the 24th, we have lost a number of mechanics to go to Great Britain to work on war munitions, but not as many as we have lost to concerns in neighboring cities to work on their shell contracts, nor any more than we have lost to local concerns, nor yet so many as we have lost by enlistments.

While all of these losses annoy us temporarily, there is such a large number of inexperienced men available that our solution of the labor problem is to retain a sufficient number of skilled men as instructors, tool men and repair men, and to train new men as operators on the various machines. The work being so repetitive makes it less difficult to train men than for any of our regular products.

There are so many men out of work in the country it does not appear wise or necessary to complain about any who go to Great Britain to work on munitions of war, or who have the courage and patriotism to enlist in any of the contingents.

Yours truly,

——————

* * *

Canadian Machinery,
Toronto.

Gentlemen:

Replying to your favor of the 24th ult., so far we have not heard of any large number of mechanics leaving this country for Great Britain to engage in the manufacture of war munitions, etc. It is quite likely some will go, but we expect it will be more with a view to having a visit to the Old Country. Of course it would seriously affect manufacturing here in Canada if there was a very large exodus, especially with improved conditions of business, but we are of the opinion that this will not take place.

Yours truly,

——————.

* * *

Canadian Machinery & Manufacturing News:

Dear Sirs,—We beg to acknowledge receipt of your favor of the 24th inst. with reference to mechanics leaving for the other side to engage in the manufacture of munitions of war. In this connection we may state that as far as we are aware none of our employees have gone over to the other side.

Considering the number of applications which we receive from day to day from men seeking positions as mechanics and machinists, we do not anticipate that there will be any shortage in labor of this type.

Yours faithfully,

——————.

* * *

Editor, Canadian Machinery:
Toronto.

Dear Sir,—We have your favor of the 24th instant, and beg to inform you that a great many of our employees have returned to Great Britain to work on munitions of war, and some have joined the colors.

Right at the outbreak of war we lost quite a number of men from all the departments in our works, and later, when the call for machinists and other mechanics to go to Great Britain was sent out, we lost still more men from our machine shop, although at that time we were manufacturing shells for the Imperial Government. The result was that we had to go out on the street and employ men who had never seen a lathe or a machine shop, and our operations have, therefore, been seriously handicapped. We now, however, have got over most of our difficulties in this regard.

We, like other manufacturers, felt that the men employed on munitions of war in our shops would be doing quite as much service for the Empire as if they were employed in some shop in the British Isles. Of course there may be other considerations which we are not aware of and which would make their services of more value there than here, but we honestly cannot imagine what these reasons might be unless they were going to equip fully organized shops, instead of waiting in Canada until a great many of the firms which are now at this business could equip and go ahead.

If the Empire is benefited in this way, then very little complaint could be made regarding the men being drafted across the Atlantic.

Yours very truly,

——————.

* * *

Editor Canadian Machinery,
Toronto:

Dear Sir,—In answer to your letter of June 24th, requesting information as to how we have been affected by the demand for mechanics for munition work in Great Britain, we have not found any actual difficulty in maintaining our supply of labor due to this cause.

The effect of the great advertising that this subject has received seems to have been to unsettle the men, a great many

of whom although not now employed, do not show the same keen desire to obtain employment that would be the case if they had not in mind that work with exceptional wages could be obtained at any time in England.

Their impression seems to be that the wages and other financial inducements offered by the British Commission are high, even judged by present Canadian standards, and it is our opinion that if the daily press gave full publicity to the actual rates to be paid men for munition work in England, there would be little danger of there being any shortage of labor here due to emigration to England.

We shall be pleased to give you any further information which might be of help to you on this subject.

Yours truly,

——————.

RECRUITING FOR OVERSEAS CONTINGENTS.

IN view of the fact that but slow progress is being made in recruiting for additional overseas contingents, the following figures from the official census returns make it abundantly clear that resources are not lacking. We are shy on manliness, it would appear.

Census returns show that Toronto in 1911 had a male population of 107,574, whose birthplace was Canada, and a male population of 58,185 British-born. The total male population of Ontario between twenty and thirty-nine years of age in the same year was 438,295 out of 1,229,290 of all ages, or about 35 per cent. Applying this ratio, or say, 33 1-3 per cent., to Toronto figures, the result is 35,858 Canadian-born and 19,395 British-born between the ages of twenty and thirty-nine, the recruiting ages.

The census also shows that about 50 per cent. of males between these ages are married.

HARDNESS TEST OF SHRAPNEL SHELLS.

NOT the least important of the many operations which have to be performed in order to produce high quality shrapnel shells is that of "testing for hardness." A narrow strip round the body of the shell near the band groove is first polished, after which the shell is taken to the scleroscope. This apparatus consists of a vertical glass tube with an arrangement at the top for drawing up the steel hammer in the tube and a catch for holding the hammer until released. This part of the apparatus is operated by a rubber air bulb. At the back of the tube is a scale on which are figures which bear relation to the hardness of specific metals.

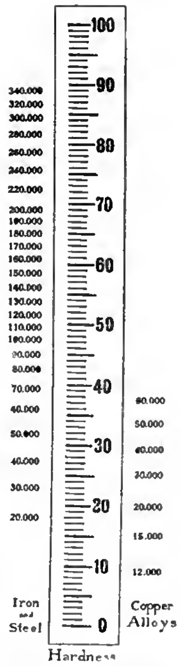
The shell is placed in a grooved block under the scleroscope and the diamond pointed steel hammer allowed to drop on the polished part of shell. The hammer rebounds and the figure at which it stops is noted by the operator. This is repeated several times, the shell being moved round each time. The hardness required of shrapnel shells must be around 45, a slight variation above or below being allowable.

The shell must not rupture at the point tested when its contained charge is exploded nor when the charge in the case is set off. Should the shell upset near the rifling band groove when being propelled out of the gun, it would of course destroy the rifling of the latter.

Experience with the scleroscope has disclosed the existence of a definite relation between the hardness and strength of metal. In determining the strength of metal, two stages are recognized: First, the elastic limit, yield point or load required to start a permanent set; second, the ultimate strength or load required to terminate permanent elongation and reduction of area in rupture.

The hardness indicated by the scleroscope is intimately related to the elastic limit, as shown by the scale cut. The elastic limit increases more rapidly than the hardness from 43 to 45, this being the minimum index of the strength value required. As an elongation of 8 per cent. in 2 inches is also called for, there must necessarily be an upper limit to the hardness. On the steel used for shrapnel which is generally about 50-point carbon, 70-point manganese, the maximum hardness should not be over 60 on the scleroscope.

TESTING SHELLS FOR HARDNESS WITH "SHORE" SCLEROSCOPE.



ELASTIC LIMITS (TENSILE) SYMBOLIZED BY THE SCLEROSCOPE HARDNESS UNITS.

EFFICIENCY.

EFFICIENCY is usually stated as the ratio of what a thing is to what it ought to be when measured by some assumed standard. When efficiency in any direction approaches 99 per cent., the amount of energy or cost required to increase it becomes entirely out of proportion to the benefits to be obtained, being governed by the well-known law of diminishing returns. It is possible, therefore, to strive too much after any one kind of efficiency. Put in another way the attainment of excessive efficiency in one direction often results in great inefficiency in another, the net combined result being low efficiency.

What is mechanically efficient may thus be commercially inefficient, and what is commercially efficient may (as money is not the only thing in the world to be desired) be totally very inefficient. The difficulty is to define total efficiency except by such indefinite phrases as "the best result at the least cost," but when it comes to defining what is the best result and what the least cost is to be measured by, then we find ourselves entangled in metaphysical reasoning of the kind that leads to nothing or may be made to lead to anything.

Machine Tool Commercial Efficiency.

To the purchaser of a machine tool, commercial efficiency is a more or less definite matter. The acquisition of a new machine tool involves the incurrence of liabilities. The interest and depreciation charges, the running expenses and the workman's wages are amounts that can be written down in figures.

Against these expenses is put the value in money of the output of the machine, and the ratio of one to the other measures the commercial efficiency of the machine from the owner's point of view. Questions of internal friction or even of personal happiness may not figure in his calculations and what to the professor or to the humanitarian might be very inefficient may be the reverse from a business point of view and vice versa.

The efficiency of a machine tool should not then be judged so much by the amount of power it wastes as by the amount of work it does, and it is quite conceivable that a machine which showed the highest possible mechanical efficiency when tested in a laboratory by a dynamometer might be most unsatisfactory from a work-producing point of view. Its handles might be in inconvenient positions, and its adjustments awkward to make; its slides might be badly proportioned and wobbly, and its frame too weak; it might be short of important movements and of other facilities for doing work quickly; and yet, in spite of all these defects, its mechanical efficiency figure might be much better than that of a machine with none of these defects. Again, the efficiency of a lathe is sometimes judged by what it will do on heavy cutting, whereas in its everyday work it may seldom or never have such work to do, and may easily be too clumsy and unhandy for the lighter work on which it is mainly employed.

The Point of View Factor.

A great deal depends on the point of view of the seeker after efficiency, and it is fortunate that, in the main, common sense is found to triumph over academic dogma. If, to take a somewhat far-fetched example, the ideal is to get rich quickly regardless of all else, then the most efficient plant, from the point of view of that ideal, may be mechanically imperfect, not durable, and unhealthy, dangerous or laborious to the operator.

If, on the other hand, the owner of the plant has the more legitimate ideal of producing the largest profit in his business that is compatible with good conditions of health, safety, convenience and wages of the workers, and with the building up of a sound and permanent business that can be handed down to future generations, then the measure of efficiency must be taken by a different scale, but in both cases the word must be understood to convey something very different from the bloodless and soulless mechanical efficiency of the schools.

The standards in such matters are set partly by the conditions under which the work is to be done, but also by the general sense of the community, and are higher now than ever before, the tendency to-day being to consider the worker as much as the work by the provision of protective devices and of conveniences for easy handling, the efficiency of which in a broad sense is universally admitted, although difficult to represent by anything of the nature of a numerical percentage.—A. H. M.

THE LATE THOMAS D. WEST.

THOMAS D. WEST, for many years one of the most widely known men in the foundry trade in the United States and a high authority on foundry practice, died at Glenville Hospital, Cleveland, Ohio, June 18, from injuries received by being struck by an automobile on the previous day. He was 64 years of age. As chairman of the board of directors of the West Steel Casting Company, Cleveland, he actively co-operated with his son, Ralph D. West, president of the company, but for several years had spent much of his time in promoting safety work in foundries and in other efforts for the benefit of foundrymen and their employees.

THE LATE THOMAS DYSON WEST.

Mr. West was born in Manchester, England. At the age of 12 he started to learn iron founding at the plant of the Portland Locomotive Company, Portland, Maine. In 1887 he organized the Thomas D. West Foundry Company, Sharpsville, Pa., now known as the Valley Mold & Iron Company, maker of ingot molds. He was vice-president and shop manager from its organization until 1909. He organized the West Steel Casting Company, Cleveland, in 1907.

Mr. West was president of the American Foundrymen's Association in 1905 and 1906, and was an honorary member of that association as well as of the Pittsburg, Philadelphia, and other associations of foundrymen. He was also a member of the American Society of Mechanical Engineers, the American Society for Testing Materials, and several other mechanical and scientific societies. He was author of "American Foundry Practice," "Molders' Text Book," "Metallurgy of Cast Iron," "The Competent Life," "Accidents: Their Cause and Remedies," and a large number of technical papers for engineering and foundrymen's associations. Two of his works have been translated into French and German.

"TNT." PRODUCTION IN CANADA.

THE report that the Minister of Militia has inspected the plant for the manufacture of trinitrotoluol, erected for the Dominion Steel Corporation, and the statement by the president of the corporation, J. H. Plummer, that the first lot of "TNT" has been completed to the satisfaction of the War Office representatives, mark an important step in the Canadian manufacture of munitions of war.

That "TNT" should be made in Canada is due to the persistent efforts of Mr. Plummer, and the soundness of his judgment in entrusting the contract for the nitration of the company's toluol to a Canadian concern is justified by the fact that, while the best English houses asked for five to six months to put up the necessary plant, the Canadian firm completed the work in two months. The benzol plant at Sydney, at which the first step in the process is taken, was erected in less than two months, and, taking the two plants together, the enterprise shows what can be accomplished in Canada when the need exists. It is a little over three months since the first contract was given to the Steel Company for toluol, and not over two months since the contract was extended to cover trinitrotoluol, and the delivery of finished "TNT" already by the Steel Company is creditable to all concerned.

It is due to Mr. Plummer that the supply of toluol available at the Algoma Steel Corporation by-product plant at Sault Ste. Marie is also to be utilized. The plant has been erected under his auspices, and, through his efforts it will be ready during the present month.

Field Guns.—These guns are, of course, made as light in scantling as possible. In order to achieve this, it is necessary to keep the maximum barrel pressure at a low figure, and, therefore, a slow-burning powder is in most cases used for the cartridge. There is a certain analogy, very slight no doubt, between what takes place in a gun at the time of discharge and what takes place in a gas engine at ignition.

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THE SHELL SITUATION.

CANADA has come in for scathing criticism at the hands of Lord Curzon for her failure to deliver shells ready for the firing line as quickly as was expected, and we may be fairly certain that there exists some ground for his Lordship's remarks. In the way her natural and industrial resources have been mobilized in the defence of the Empire, Canada as a nation has no warrant to be over-proud.

Long after it became evident that the entire resources of the Empire would be needed for the prosecution of the war, a Shell Committee was appointed by the Minister of Militia. Its operations apparently were confined to distributing orders—not to obtaining orders and training and mobilizing the Canadian resources to handle them. This aspect of the situation, with its important bearing upon our exports, does not appear to have engaged the attention of the Trade and Commerce Department at Ottawa. Formally, and within the limits set by military authorities, the Shell Committee proceeded to let contracts, counting entirely upon the individual manufacturers' desire for profit as an incentive to build up a great industry over-night.

From the first there was considerable doubt as to whether Canada had the capital, plants or skilled labor necessary for the production of shells on a large scale, and it is equally clear that the British Government did not count very much on Canada in this business. The Minister of Trade and Commerce of the Dominion, through his many agents, and by virtue of the position he holds, should therefore have made it quite clear to our own military authorities and to those in London that resources in Canada for the production of munitions were very considerable, and should be utilized.

If there was need of technical advice of any kind, the Minister of Trade and Commerce should have obtained it and made it available to every machine shop in the Dominion that could be turned to account economically. There should have been no doubt left on the mind of the Director of Army Contracts in Britain as to the ability of Canadian manufacturers to produce shells.

During the first eight or nine months of the war some of our largest manufacturers on their own initiative groped their way in the production of shells with such knowledge of methods, devices and equipment as they were fortunate enough to pick up from the technical press and elsewhere. There appears to have been no concentrated effort upon the part of Government to marshall the resources of Canada for the work. Nothing of an educative or informative character seems to have been thought of. No effort was made to find out what force of skilled labor Canada could throw into the business of shell-producing.

In a crisis such as the present, it is the duty of the Government to take all the responsibility for the welfare of the nation that it can. Lloyd George wants shells, but he cannot deal with every producer individually.

Pending official readjustments now in process with the idea of developing and still further enlarging the scope of the shell industry in Canada, our manufacturers, in view of the certainty of a long drawn-out struggle, and of an insistent and increasing demand for shells, would do well to "set their houses in order"—make use of and add to their available resources—capital, plant, equipment, men and material. Patriotism demands it, and were there nothing else, that should be sufficient. There is, however, profit—that arising out of both experience and money.

Only by some such wholehearted and concerted action will we secure immunity from that criticism of incapacity of administration and inability to measure up to requirement to which we have been recently subjected.

Representative of Canadian manufacturers, their families and administrative staffs who have heeded the call of Empire for active service on our various overseas contingents.

LT. T. E. RYDER,
Can. Fairbanks-Morse Co., St. John, N.B.

CAPT. J. K. BERTRAM,
Graduate R.M.C., Kingston, and son of Dr. Bertram, Dundas, Ont.

LT. W. H. McLAREN,
Of McLaren's, Ltd., Hamilton, Ont.

LT. G. C. WRIGHT,
The E. T. Wright Co., Hamilton, Ont.

LT.-COL. J. A. GUNN,
Of Gunn's, Ltd., Montreal.
O.C. 24th Battalion (Victoria Rifles), C.E.F.

LT. R. G. HUTCHISON,
International Harvester Co. of Canada.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey Forge, Pittsburgh		$13 45
Lake Superior, charcoal, Chicago		15 75
Ferro Nickel pig iron (Soo)		25 00

	Montreal.	Toronto.
Middlesboro, No. 3	21 00	.....
Carron, special	22 00	.....
Carron, soft	22 00	.....
Cleveland, No. 3	21 00	.....
Clarence, No. 3	21 00	.....
Glengarnock	25 00	.....
Summerlee, No. 1	25 00	.....
Summerlee, No. 3.....	25 00	.....
Michigan charcoal iron.	25 00	.....
Victoria, No. 1	21 00	19 00
Victoria, No. 2X	21 00	19 00
Victoria, No. 2 Plain..	21 00	19 00
Hamilton, No. 1	20 00	19 00
Hamilton, No. 2	20 00	19 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto..	2.10
Steel bars, f.o.b., Toronto	2.10
Common bar iron, f.o.b., Montreal	2.15
Steel bars, f.o.b., Montreal	2.15
Bessemer rails, heavy, at mill....	1,25
Steel bars, Pittsburgh	1.20
Twisted reinforcing bars	2.15
Tank plates, Pittsburgh	1.20
Beams and angles, Pittsburgh ...	1.20
Steel hoops, Pittsburgh	1.25
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.10
Small shapes	2.35
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ¼ to ½ in., 100 lb.	$2 35	$2 25
Heads, per 100 lb.	2 55	2 45
Tank plates, 3-16 in.	2 60	2 45

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$12 50	$12 50
Copper, crucible	14 50	14 50
Copper, unch-bled, heavy	14 00..	14 00
Copper, wire, unch-bled.	14 00	14 00
No. 1 machine, compos'n	12 50	12 50
No. 1 compos'n turnings	9 25	9 25
No. 1 wrought iron	6 00	6 00
Heavy melting steel....	5 75	6 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings....	12 00	12 00
No. 1 brass turnings....	10 00	10 00
Heavy lead	5 00	5 00
Tea lead	$3 75	$3 75
Scrap zinc	14 00	14 00

W. I. PIPE DISCOUNTS.

Following are Toronto jobbers' discounts on pipe in effect June 25, 1915:

	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
Standard				
¼, ⅜ in.	63	32½	....	....
½ in	68	41½	....	....
¾ to 1½ in. .	73	46½	....	....
2 in.	73	46½	69	42½
2½ to 4 in. ..	73	46½	72	45½
4½, 5, 6 in. ..	....	....	70	43½
7, 8, 10 in. ..	....	....	67	40½
X Strong P. E.				
¼, ⅜ in.	56	32½	....	....
½ in.	63	39½	....	....
¾ to 1½ in. ..	67	43½	....	....
2, 2½, 3 in. ..	68	44½	....	....
2 in.	....	....	63	39½
2½ to 4 in. ..	....	....	63	42½
4½, 5, 6 in. ..	....	....	66	42½
7, 8 in.	....	....	59	35½
XX Strong P. E.				
½ to 2 in.	44	20½	....	....
2½ to 6 in. ..	....	....	43	19½
7 to 8 in......	....	....	40	16½
Genuine Wrot Iron.				
⅜ in.	57	26½	....	....
½ in.	62	35½	....	....
¾ to 1½ in. ..	67	40½	....	....
2 in.	67	40½	63	36½
2½, 3 in.	67	40½	66	39½
3½, 4 in.	....	....	66	39½
4½, 5, 6 in. ..	....	....	63	36½
7, 8 in.	....	....	60	33½

Wrought Nipples.	
4 in. and under	77½%
4½ in. and larger	72½%
4 in. and under, running thread.	57½%
Standard Couplings.	
4 in. and under	60%
4½ in. and larger	40%

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws....	65%
Sq. Head Set Screws ....65 &	10%
Rd. & Fil. Head Cap Screws......	45%
Flat & But. Head Cap Screws....	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in. N.	70%
Semi-Fin. Nuts up to 1 in.	70%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

METALS.

	Montreal.	Toronto.
Lake copper, carload ..	$21 50	$21 50
Electrolytic copper	21 25	21 25
Castings, copper	21 00	21 00
Tin	45 00	46 00
Spelter	26 00	28 00
Lead	7 50	7 50
Antimony	40 00	40 00
Aluminum	35 00	35 00

Prices per 100 lbs.

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh...	$20 00
Openhearth billets, Pittsburgh..	20 00
Forging billets, Pittsburgh	25 00
Wire rods, Pittsburgh	25 00

NAILS AND SPIKES.

Standard steel wire nails, base	$2 40	$2 35
Cut nails	2 50	2 70
Miscellaneous wire nails..	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

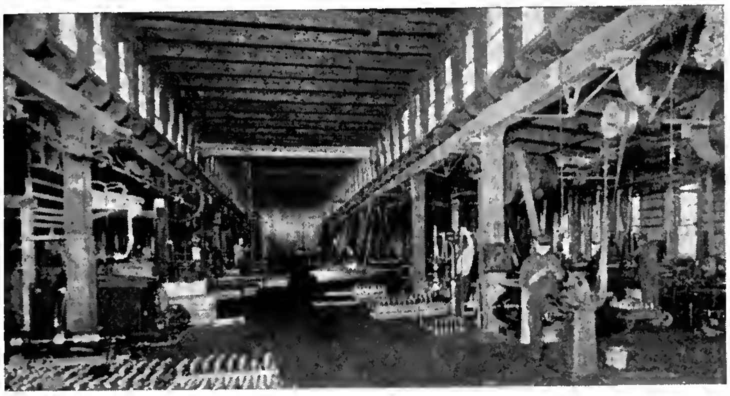
BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	75
Stove bolts	80
Plate washers	40
Machine bolts, ⅜ and less......	70
Machine bolts, 7-16 and over....	60
Blank bolts	60
Bolt ends	60

Machine screws, iron, brass.....35 p.c.
Nuts, square, all sizes..4¼c per lb. off
Nuts, Hexagon, all sizes.4¾c per lb. off
Iron rivets .... 72½ per cent.
Boiler rivets, base, ¾-in. and larger $3.25
Structural rivets, as above....... 3.25
Wood screws, flathead, bright ....85, 10, 7½, 10 p.c. off
Wood screws, flathead, Brass ....75 p.c. off
Wood screws, flathead, Bronze ....70 p.c. off

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Standard. Price. per ft.	Extra Strong, Sizes Ins.	Extra Strong, Price per ft.	D. Ex. Strong. Size Ins.	D. Ex. Strong. Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.....
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....



Shrapnel Shell Manufacture

Shell Department of a General Engineering Works

Staff Article

Perhaps the most fortunate of the various manufacturing institutions in its ability to readily take over the shell business is the general engineering plant. The equipment usually requires comparatively slight alteration, and there are also at hand the type of men and scope for designing and building any necessary special apparatus at short notice.

MORE 18 pounder shrapnel shells have been made in Canada, than have any other size and denomination since the industry was started here some ten months ago, and every shop has its own system worked out and has tooled up in manner that will best utilize the equipment installed. Thus, upon entering this particular plant which carried on a general engineering business previous to the outbreak of the war and the inauguration of the industry of shell making, we are confronted with some extremely interesting tooling. The present shell shop was originally that known as the compressor shop. It is a new and up-to-date building standing somewhat apart from other and older buildings.

Primary Operations.

The shells are received in the main machine shop where they have their open ends marked off roughly to length with scratch awl gauges. They are then chucked in a "Bertram" engine lathe, carrying a universal chuck, and the open end is cut off to rough length with a parting tool. The shells are next carried over to the shell shop, the first operation there being to face the bases roughly. This is done on a vertical boring mill manufactured by H. Bickford & Co., Lakeport, N.H. To the table is bolted a jig which is capable of having twenty-four shells clamped to it. The machine is shown in Fig. 1. Both heads are utilized so as to divide the working strains over the machine more evenly. The machine is motor-driven by a 10 h.p. General Electric Co. motor. Four tools in all are used, two being attached to each head.

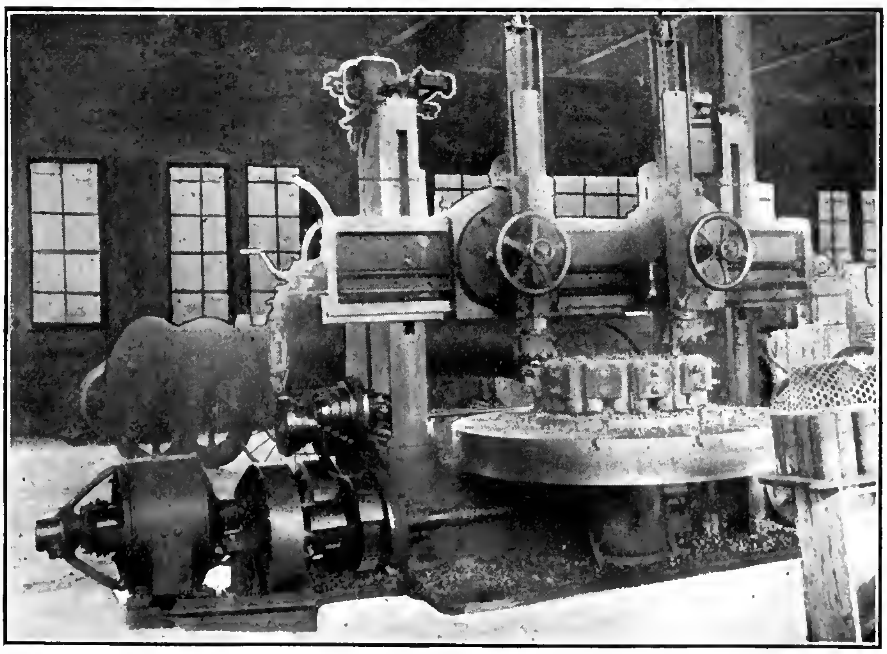


FIG. 1. FACING BACK END OF SHELLS ON AN H. BICKFORD & CO. VERTICAL BORING MILL.

Rough-Turning.

The shells next pass on to the rough turning operations. Two "Bullard" vertical boring mills are used for this. The boring mills are each fitted with a turret on which the various tools are carried, and both machines are motor driven. Fig. 2 shows one of the boring mills tooled up for the work. This machine is to all intents and purposes a vertical turret lathe. On the table is fitted an expanding chuck, the details of which are given in Fig. 3. The shell is chucked on this arbor. A fixture corresponding to the cross slide on a lathe carries several of the tools in a revolving tool holder.

A tool carried on the cross slide and ground with a wide cutting edge faces the base of the shell. A rough-turning tool, projecting from the same side of the tool holder as the facing tool is next brought up to the work and a rough taper is formed on the end of the shell to allow the rollers on the box tool following immediately to take up the work. This box tool is carried on the turret, and rough turns the shell down to a distance of $1\frac{3}{4}$ inches from the end. The following rollers prevent the shell from springing away from the tool to any extent.

For the next operation the turret is swung, and another box tool of similar design is brought into the work. This tool is carried on the turret and finish turns the shell up as far as the driving band recess.

The next operation is to form the radius on the base of the shell and to rough turn and form the driving band groove. These tools are carried on the cross slide. The shell is, however, supported by rollers from the turret during this operation. The last tool in this operation is a rough taper forming tool

carried on the cross slide. It turns the rough taper on the open end preparatory to nosing. A "Gisholt" turret lathe is also tooled up to accomplish these operations. No lubricant is used on the vertical boring mills, but, on the "Gisholt" turret lathe, a soda water compound is employed.

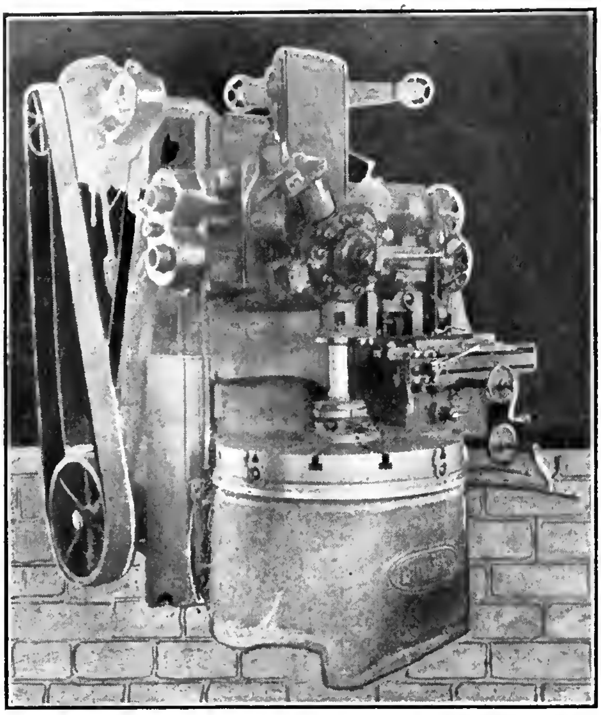


FIG. 2. "BULLARD" VERTICAL BORING MILL TOOLED-UP FOR ROUGH TURNING SHELLS.

Boring.

The boring of the shells is accomplished on two "Jones & Lamson" flat turret lathes. These are equipped with "D. E. Whitton" self-centering chucks. There are two boring bars from the turret, one carrying the roughing cutters and the other carrying the finish cutters. The latter are placed in the bars inclined a little to the horizontal —about an angle of 10 degs. to 12 degs. After these two operations are accomplished, the turret is swung again and the unfinished portion of the shell is rough turned and the nose faced. This constitutes the series of operations on the turret lathes fitted up for the boring operations. Fig. 4 shows one of the turret lathes fitted up for the boring, while Fig. 5 shows the gauges used to test the shell after boring. These gauges test the thickness of metal in the base, the distance between the bottom of the powder pocket and the diaphragm seat, and also the profile of the powder pocket and the diaphragm seat.

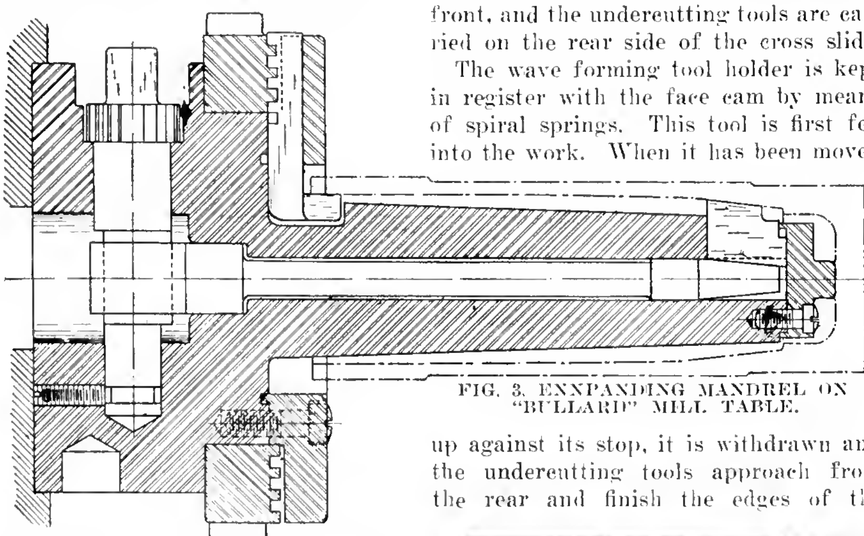


FIG. 3. EXXPANDING MANDREL ON "BULLARD" MILL TABLE.

Machining the Driving Band Recess.

Two engine lathes are tooled up to accomplish this work. One is a motor driven "C. M. C." engine lathe and the other is a "Bertram" engine lathe. Fig. 6 shows the "C. M. C." lathe. A split box chuck is attached to the face plate. The shell is chucked up against a stop A split bush is placed on the shell and the chuck closes down on this bush. On the face plate is bolted a three-point face cam, which is integral with the split chuck. The wave forming tool is carried on the cross slide of the lathe at the front, and the undercutting tools are carried on the rear side of the cross slide.

The wave forming tool holder is kept in register with the face cam by means of spiral springs. This tool is first fed into the work. When it has been moved up against its stop, it is withdrawn and the undercutting tools approach from the rear and finish the edges of the groove. These tools are fitted to small tool holders, which travel in slides at an angle to the work. In this manner the undercutting is accomplished. With the completion of this operation the groove is finished. The "Bertram" lathe is tooled up in an exactly similar manner.

Heat Treatment.

The shells are next taken to the heat-treating department. Small oil furnaces, capable of taking in seven shells at a time, are installed. The shells are heated to 1,600 degs. F., and kept at that temperature for twenty-five minutes. A small furnace, accommodating only four shells, is also used. A "Hoskins" pyrometer is employed to keep tab on the temperatures of each furnace, and can be connected to any of the furnaces in the department. Upon being removed from the hardening furnaces, the shells are placed in a large vertical cylindrical tank of seal oil, being held in a woven wire basket and lowered into the tank. The oil, of course, absorbs a great deal of heat from the shells, and in order to keep it cooled to those temperatures at which the best results are obtained, cold water coils are placed in the bottom of the tank. To further cool the oil, jets of compressed air are also requisitioned.

The shells are removed and the surplus oil is allowed to drain from them. They are then tumbled in sawdust to remove any oil that may still remain. Following this they go to the oil burning annealing furnaces where they are kept at a temperature of 500 degs. F., for ten minutes. Upon being removed from the annealing furnaces their noses are heated to about 1,400 degs. F., in a lead pot; two shells at a time being thus heated.

FIG. 4. JONES & LAMSON FLAT TURRET LATHE TOOLED UP FOR BORING SHELLS.

They are placed on a wrought iron shelf which is submerged in the molten lead.

The shells are nosed on a motor driven rivet press to which suitable dies have been fitted. Two strokes of the punch perform the operation. After being closed in, the noses are again heated to a dull red and placed in trays of powdered lime. This latter process tends to anneal the noses and remove all traces of chill due to the hot metal striking the cold nosing.

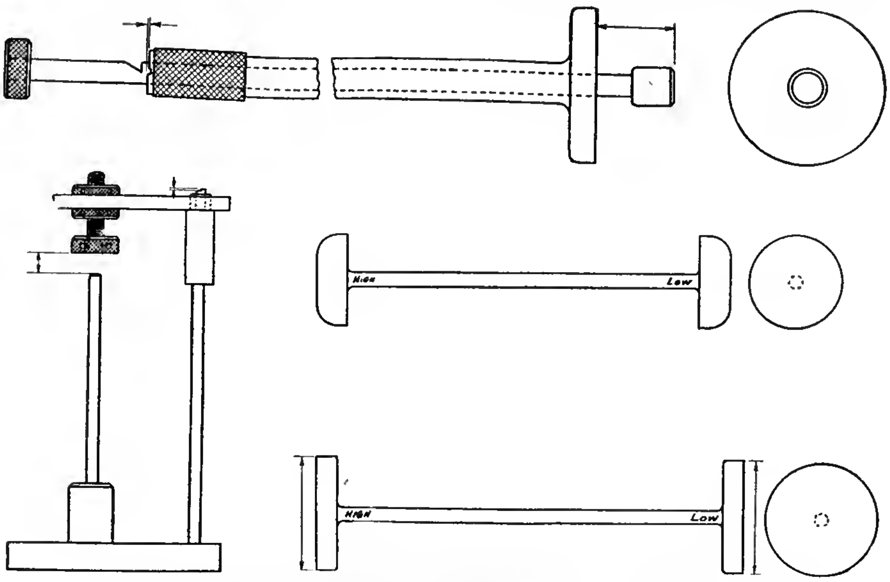


FIG. 5. GAUGES USED IN THE MACHINING OF SHRAPNEL SHELLS.

Finishing Inside of Nose.

The shells are taken back to the shell shop from the heat treating room and there the inside of the nose is machined. Three lathes are tooled up for this work. One is a London Machine Tool Co. product, the second a "Bertram" lathe, and the third a motor driven Canada Machinery Corporation lathe. The tooling on all three lathes is similar, turrets being fitted to the cross slides of the lathes. Fig. 7 shows the London Machine Tool Co., lathe fitted up with the turret on the carriage to do this work. A split chuck is screwed to the live spindle of the machine and is carried in an outer bearing. The shells are chucked against a stop. Fig. 8 gives a layout of the tools carried on the turret.

The first operation is to bore the nose, the second is to rough face it, and the third to finish face it. The nose is then tapped with a collapsible tap. Finally, the inside turning and forming tool is fed into the work. Suitable stops are fitted to all three lathes, which stops control the operations of the various tools.

Finish Turning and Grinding.

The finishing operations are done on a "Landis" grinder, but previous to the grinding operation the shells are turned and formed to within fifteen or twenty thousandths of finished size. The turning operations are accomplished on a "Bertram" lathe equipped with a special forming cam. The cross feed has been disconnected, and weights suspended from wire cables attached to the cross slide keep it in register with the forming cam. This operation is also accomplished on a Fitchburg Machine Co. "Lo-Swing" lathe, the taper attachment being modified so as to take care of the special form. The third lathe on this work is a "Bertram" engine lathe but no forming cam is attached to it, being simply used to turn the straight portion of the body.

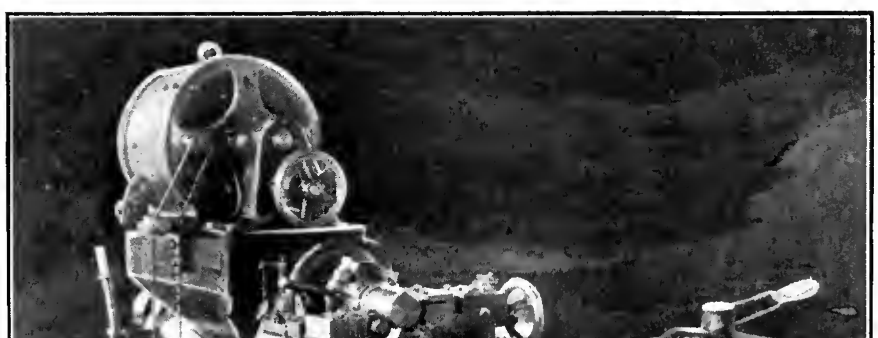


FIG. 6. CANADA MACHINERY CORPORATION MOTOR-DRIVEN ENGINE LATHE TOOLED-UP TO TURN THE COPPER DRIVING BAND RECESS.

A plug centre is screwed in the nose of the shell to enable it to be put in the lathes, the centre being on an extended shank upon which two flat sides have been ground. A driving dog is placed on the shank so that the shells are placed with their noses towards the lathe headstocks. The other end of the shell is carried in a revolving centre. On the Landis grinder a large stone dressed to the profile of the shell finishes the body and the nose at one operation. The grinder is a heavy one, being a 20 in. x 120 in. machine. A special plug centre is screwed in the nose of the shell and acts as a driver, while the other end of the shell is supported in a revolving centre. The wheel is frequently dressed to insure the production of accurate bodies and noses, and excellent production results have been obtained.

Two Canada Machinery Corporation lathes are fitted up for finish turning the shells, both being equipped with forming cams and having their cross feeds disconnected. The first lathe is driven by a motor manufactured by the Reliance Electric & Engineering Co., of Cleveland, Ohio. The face plates have been removed and the fixture shown in Fig. 10 substituted. A dog on the base end of the shell engages with the driver A and drives the shell. A plug centre in the nose of the shell is supported by the tail stock spindle. The second lathe has a universal chuck which is used to grip the base and drive the shell. This lathe in other respects is similar to the other.

The shells are next sandblasted and cleaned up, particularly so in the recess grooves and bases. They then pass on to the preliminary Government inspection.

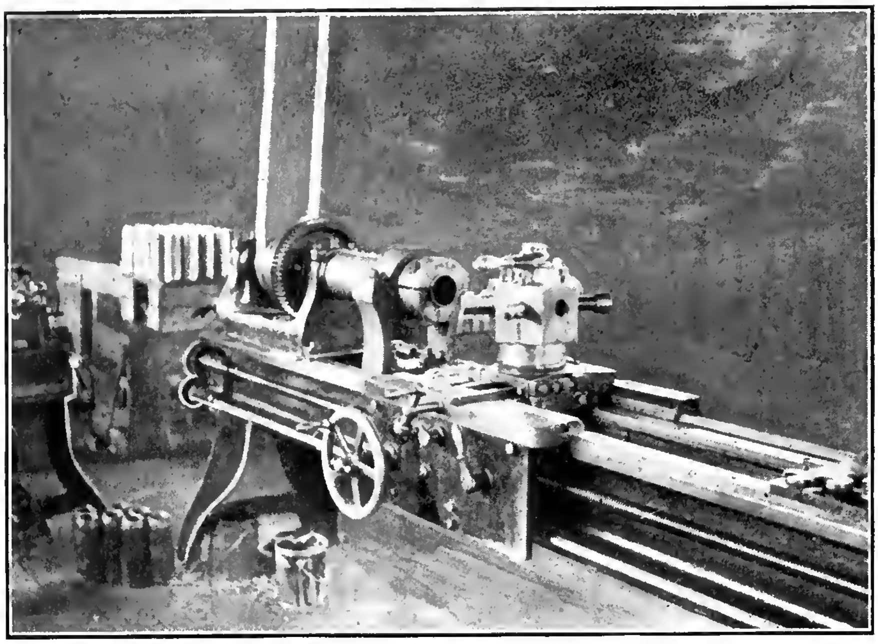


FIG. 7. LONDON MACHINE TOOL CO. ENGINE LATHE FITTED WITH SPECIAL TURRET ON CARRIAGE FOR MACHINING INSIDE OF NOSE.

Pressing on and Turning the Copper Bands.

The next operation is to press on the copper bands, this being accomplished on the pneumatic machine shown in Fig. 11. This machine was built at the works moves in against a stop. The roughing tool is carried on the cross slide and moves up against a stop. The finishing tool is carried on the rear of the lathe, and this tool comes down and shaves the band to size.

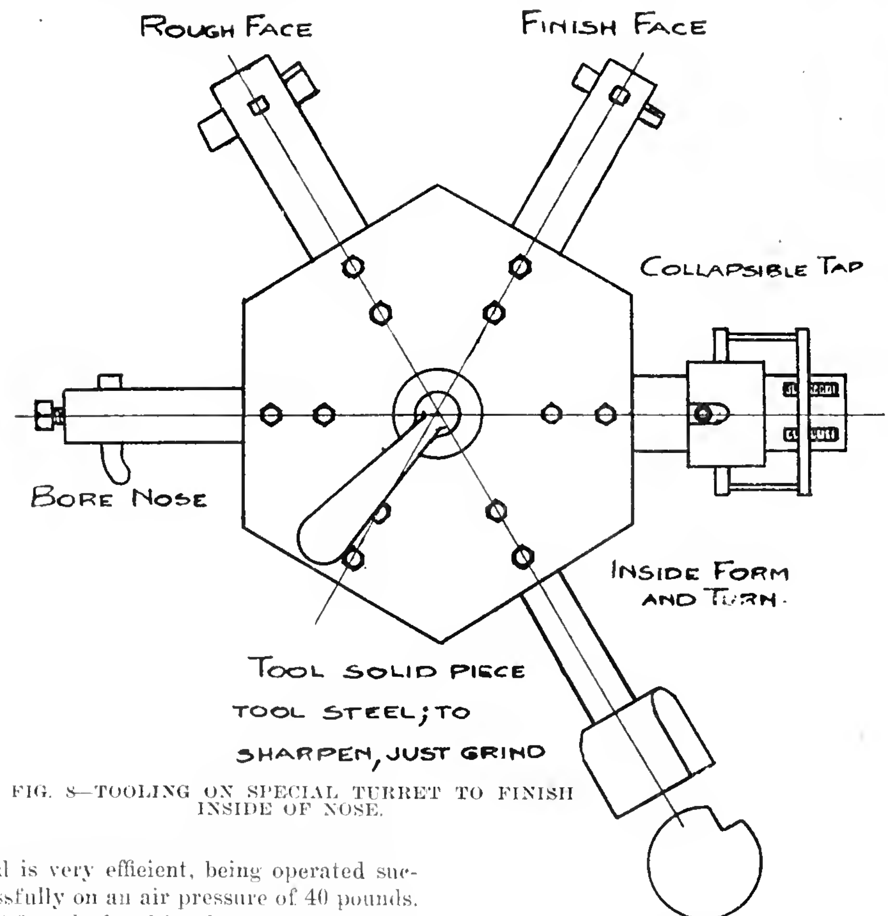


FIG. 8—TOOLING ON SPECIAL TURRET TO FINISH INSIDE OF NOSE.

and is very efficient, being operated successfully on an air pressure of 40 pounds.

After the band has been pressed on the shell, it goes to the band turning lathe shown in Fig. 12. This lathe is fitted with a universal chuck, and the shell

Assembling.

The shells now pass on to the assembling department. Here the powder cups and brass powder tubes are inserted. Running in of the shot follows. Next the molten resin is poured in, after which the shell is weighed carefully. The brass sockets are then screwed home, the thread being first coated with red lead. Next the powder tube is soldered to the socket and the shell passes on to the socket finishing lathes.

Finishing Brass Sockets.

The brass sockets are finished on an Acme Machine Tool Co. turret lathe. The base of the shell is carried in a two-jaw chuck, and the outer end is carried in a steady head as can be clearly seen in Fig. 13. The turning and forming tools which are carried on the cross slide, approach from the front and move up against a stop. The little tool which

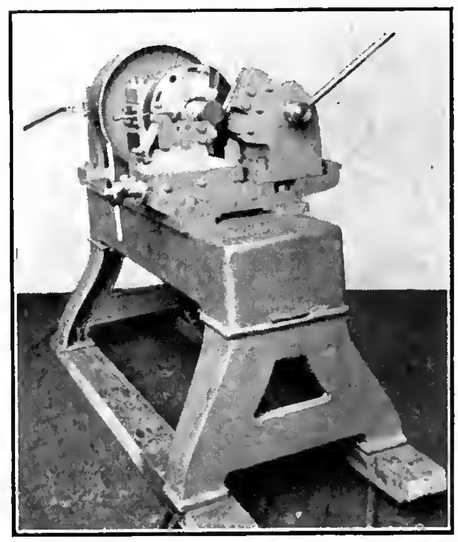


FIG. 12. JENCKES MACHINE CO. BAND TURNING LATHE.

turns down the end of the nose approaches from the rear. A spot facing tool is carried on the turret; this cleans up the projecting end of the powder tube, the central shank going into the latter. A second tool on the turret faces the bottom of the socket. This completes the socket machining operations.

Final Shop Inspection.

The shells now pass to the final shop inspection, where the sockets are tapped

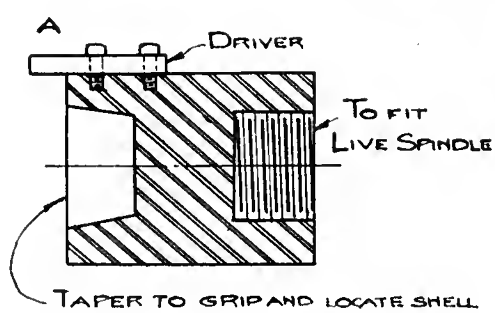


FIG. 10—FACE-PLATE ON "C.M.C." ENGINE LATHE FOR FINISH TURNING.

out, the grub screw hole tapped and also the powder tube reamed. Com-

pressed air is used to blow out dirt from the powder tube. The shells next pass to the Government inspectors who pass upon them finally.

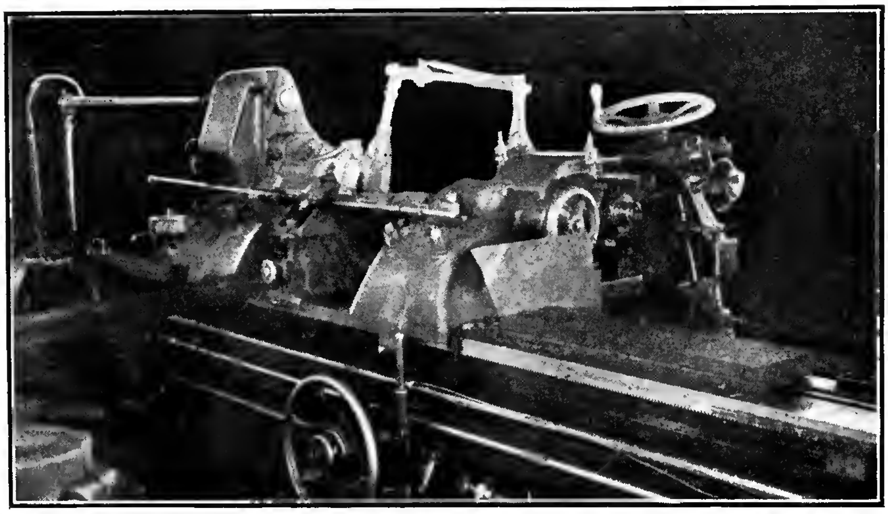


FIG. 9. "LANDIS" GRINDER FITTED UP TO GRIND THE BODY AND NOSE OF THE SHELL AT SAME TIME.

Painting.

After the shells have passed the Government inspection the little brass plugs are screwed into the socket. Small lathes are fitted up to hold the shell and revolve it for painting. The nose of the shell is supported by a square centre which fits into the brass plug and does the driving. The base is carried in a revolving centre. A priming coat of black japan is given the shells, after which they are placed on shelves to dry. Later they are replaced in the painting lathes and a finish coat of paint is applied. At the same time the noses are coated with red lead. When dry, the shells are packed in boxes of six and shipped.

General.

The shop is operated on a piece-work basis, and two shifts of men are employed. The shell output it is expected will soon reach five hundred shells per day. Excellent natural and artificial lighting is provided, and the shop is thoroughly modern and up-to-date in every respect.

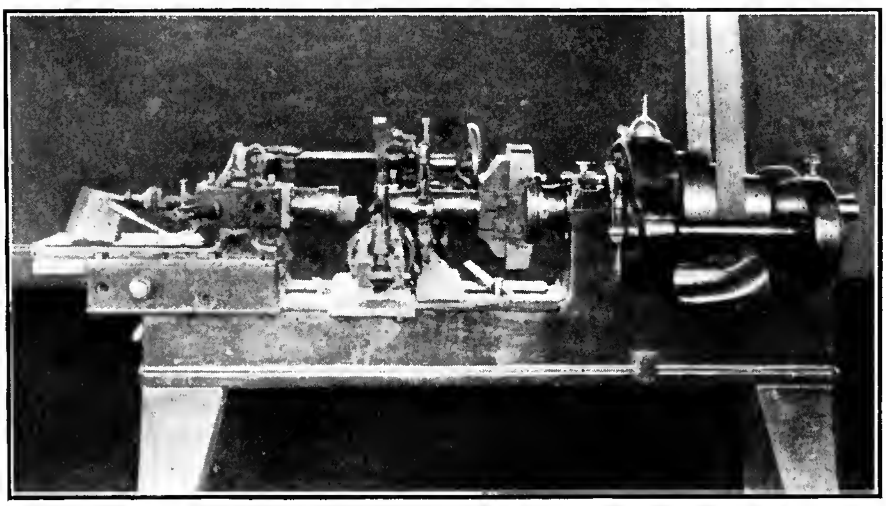


FIG. 13. TURNING BRASS SOCKETS ON AN ACME MACHINE TOOL CO. TURRET LATHE.

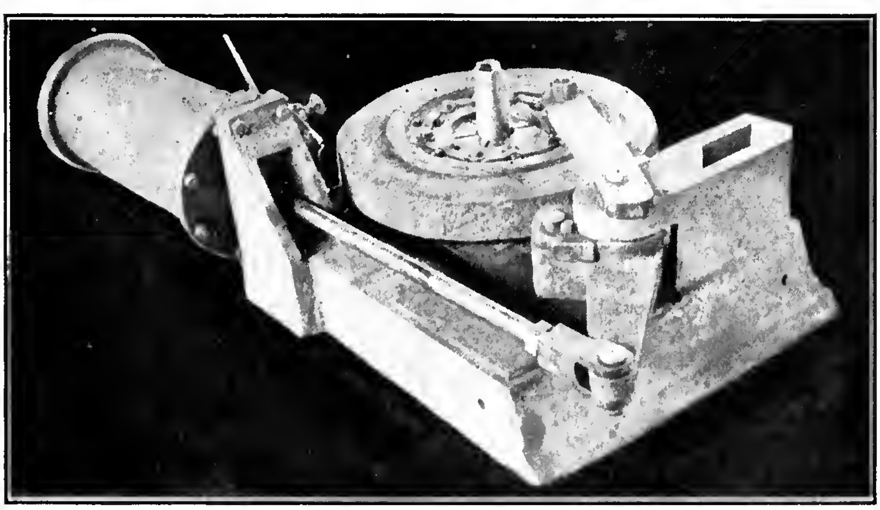


FIG. 11. JENCKES MACHINE CO. BANDING PRESS.

CARTRIDGE CASE METAL.

IN a communication to the "Manchester Guardian," a correspondent says that the tremendous price to which spelter has soared must be giving our War Department very grave concern. Continuing, the writer says: "I find that on July 31st, 1914, spelter was quoted in the region of $115 per ton and copper round $300 per ton. These prices have now advanced to around $550 for spelter and $465 for copper. In the manufacture of cartridge and shell-case metal, spelter of 99.9 per cent. purity is used, which costs about $100 per ton more than the above prices, and is exceedingly scarce at that figure.

"I have had 15 years' practical experience of metal manufacturing and hot and cold rolling, and I really do not see why the present very expensive cartridge and shell-case metal should not be displaced by hot-rolled tough copper accurately finished by the ordinary cold-rolling process. The finished cartridge and case can be drawn just as easily from copper as from the present expensive metal, and can be made much more rapidly and by more manufacturers. There are a large number of hot-rolling mills at present manufacturing copper sheet and strip whose extensive plant could be utilized.

To Deaden the Sound of War.—According to a correspondent, an interesting invention which has just been adopted by the Admiralty is known as the Mallock—Armstrong ear defender. The earpiece is no larger than the cotton wool plugs hitherto used, but contains a diaphragm of goldbeater's skin, which, while readily responsive to ordinary volumes of sound, muffles any abnormal sound. This effect is brought about by a "stop" which limits the distance through which the diaphragm can vibrate. While the ear receives readily and clearly a word of command, it is protected from the noise of the discharge of a gun.

Fire Control in Relation to Military Rifle Practice*

By Major A. C. Geddes

The last few years have witnessed a revolution in the musketry training of the British Army. A new series of ideas has been evolved and put into practice, so far as could be done in times of peace, and the new method is now undergoing its first war test. This paper gives a brief description of the work of the School of Musketry at Hythe, at which place the new ideas were worked out, and incidentally upsets our accepted ideas of rifle shooting.

THE work done during the retreat of the British Army from Mons proved conclusively that there was very little wrong with their rifle shooting, for no comparatively small force could have so fallen back in face of superior numbers if the men had not been masters of their weapon.

There is a general idea that rifle shooting is very simple; all that is necessary being to adjust the rear sight upon the weapon to suit the distance of a well-defined target, to allow for any wind that may be blowing, to aim leisurely, and to pull the trigger. This is the theory which is practised at Bisley, and those who follow it are clamoring to have it continued in its old form. The fact that this form of rifle shooting is almost useless for active service does not seem to make any difference to them.

A departure from this simple idea of firing a rifle to hit a mark must be made as soon as rapid shooting begins under service conditions, and as a result certain complications arise. For instance, it has been found by experiment that with the British rifle and Mark VI. ammunition, there is a deviation of the line of departure of the bullet from the line of the axis of the barrel, caused by the motion set up in the latter by the force of the explosion. This deviation, which is known as "jump," depends upon the nature of the charge, the muzzle velocity of the bullet, the condition of the rifle, including the bore of the barrel, the tightness of the screws holding the barrel to the stock, and whether there is a bayonet fixed or not, and with every variation in the manner in which the rifle is held.

Long Range Mark Shooting.

Therefore, on active service, the simple theory of rifle shooting is no longer true. Conditions then prevail when the rifle cannot be kept always at the same temperature, or fired so slowly that the barrel does not heat. All this at once throws doubt upon the usefulness of the expert target shot, who depends upon the perfect condition of his weapon, the accuracy of his ammunition, and the complete control under the most favorable circumstances of the breathing of the marksman and of his muscles. None of these can be depended upon with any degree of certainty while on active service.

It was proved conclusively in South Africa that great accuracy in rifle shooting at large, clearly defined targets, and at long ranges which were definitely and accurately known, is of little avail in active service, as the necessary conditions cannot be reproduced. This does not mean that great accuracy of rifle shooting is not useful at shorter ranges where all these disturbing conditions have less influence. It is laid down in the British Army training that accurate shooting at from 200 to 500 yards is of extreme importance, provided it is combined with great rapidity. Maximum rapidity of fire with individual accuracy at long ranges is, however, not worth working for, because it cannot be maintained under service conditions.

Concentrated Volley Firing.

The realization of these facts at once completely changed the training the individual soldier undergoes in the regular army. Previously efforts were made to train the men individually for long range shooting, but now they are not so trained as individual shots. Not only is it a question of barrel, ammunition and the general condition of the rifle, but there are other factors causing inaccuracy, such as barometric pressure, weather, temperature and the fact that it makes a difference whether the firing is along a horizontal line of sight or up or down from the horizontal. All these points have a serious effect on target accuracy at long ranges.

Instead, therefore, of attempting to train each man to shoot with extreme accuracy at ranges beyond 500 yards, an effort is made to use the rifles of companies or half companies as one firing machine, and to turn the stream of bullets into any area it is desired to beat with fire. This new system requires a quite different type of skill. It is first necessary to have a very highly trained firing leader who can judge distance accurately either by eye or with the aid of a range finder, and who has some way of indicating to the men who constitute his firing machine, what target he wants them to aim at.

Standardizing Rifles.

Before he can get his machine at work, although he knows how to judge distance and indicate targets to secure proper results, he has to standardize his rifles by some method which can be used in the field, and which, therefore, requires no complicated apparatus. When the rifles are thus standardized, each man can be instructed as to the range at which the backsight of his rifle is to be set to get the range desired. Rifles have been found on examination to be really ranging at 1,200 yards when the backsights were set at 1,500. Thus on service, a fire-leader must have each rifle standardized, be able to demonstrate targets, to judge distances, and to judge ground in relation to rifle firing. Many good fire-leaders were in the divisions which first went to the continent, but the casualties amongst them have been enormous.

The method of standardizing rifles is very simple. It requires an open stretch of ground and a vertical target—a barn wall or a screen or even a tree will do. Thirty yards away, the rifles are aimed at the ground line with various elevations and the point of impact marked, and from this the true range can be obtained by reference to range tables, the height above the ground being the determining point. The judging of distance is most elaborately studied.

Accuracy of Observation.

On the first day when the class arrives at Hythe to undergo instruction the men are led out to the seaside grounds, over which the school has absolute control, and asked without any previous warning to say within three minutes how many dummy soldiers are to be seen in front. On one occasion out of a squad of seven, one man saw one dummy and others various numbers, while one man saw over twenty. In reality there were fifty dummies exposed. This part of the training is to teach soldiers to observe accurately what they see.

Next it is necessary to teach the men certain standard distances first over flat ground, then over water, then over hilly ground, and then from a low point to one up a hillside; and finally from a hillside down into the valley. These standard distances are seen and re-seen until everyone is more or less familiar with them, and with the apparent sizes of dummies at these distances.

When new men become proficient in the elementary part just described, they

*From a paper read before the Canadian Society of Civil Engineers.

are given instruction of a more advanced character. First, they are taken to a hillside which commands some miles of open country and told to listen. Two or three shots are fired with blank cartridges by a man who stands up for four seconds after firing, and then disappears into the gorse or behind a wall. Each member of the class has to adjust the sights of his rifle to the range for the distance at which he estimates the man was. This is carried on until a fair standard of accuracy over the different types of ground already referred to is attained.

Judging Concealed Fire Direction.

In the next stage of instruction the firing is carried on out of sight and its direction has to be judged. After one has learned to judge the direction of firing—and that takes some men a long time to learn—the next step is to range on the nearest fold in the ground which might conceal the firers. The firer is never exposed at all, and it is extraordinary how, after training, men can accurately by sound and observation of the ground, discover the probable location of the enemy, and get his range. Once this elaborate instruction is gone through, by eye, with the instructors checking the distances accurately, men are taught the use of the range finder, but judging distance under service conditions is put first.

The fire-leader is now instructed how to indicate targets so that he can switch the whole of the fire of his machine on any point he desires. In service a target is seldom a very visible object. It may be a line of heads at a thousand yards, perhaps merely a fold in the ground, a hedge or a house, but whatever it be, if the machine composed of a company, a half company or a section is to be used properly the target must be absolutely pointed out to every man who is in the formation.

Influence of Intervening Ground.

After the fire-leader has learned to judge distances and to properly indicate targets, he has to study the effect of ground shape upon his rifle fire. Rifle fire at short ranges, especially with the modern rifle and high velocity bullet, such as used in the German and English armies, with an initial velocity of 2,400 feet a second, requires very little special sighting anywhere within a range of 600 yards, and so long as the ground is horizontal the fire is easy to control. With a rifle fired from a prone position, the trajectory up to 700 yards, is well below the head of a cavalry man and not much above the infantry, and at 600 yards or less it is well below the head of the infantry.

With these bullets and such trajectories, it is obvious that, for service work, sighting—but not aiming—hardly matters at all inside of 500, 600 or 700 yards' range because if a man lying on the ground fires at the ground line at any man approaching in the erect attitude on horseback the latter will be hit somewhere, and that enables a battle sight to be used. Of course, this is quite distinct from target shooting, for the object is to hit to kill and sighting does not alter very much unless the ground has a dip into which the enemy may sink.

At say 1,000 or 1,500 yards conditions are completely changed, because the bullet is coming down so steeply that the dangerous area is smaller, therefore, the nature of the ground is of great importance. From 600 or 700 yards outwards, then ground becomes more and more a consideration in relation to rifle fire. At a range of 2,800 yards. the culminating point of the trajectory is reached between 1,600 and 1,700 yards, the bullet then being at a height of 600 feet above the horizontal line of sight. It is this great height of trajectory at the longer ranges which is so important. A bit of ground that followed the trajectory in its curve would be a perfectly ideal field of fire because from the muzzle of the rifle to a distance of 2,800 or 3,700 yards, which may be taken as the extreme range of the modern British rifle, the whole area would be dangerous space, and nothing could advance. Such bits of ground occur only rarely, but they are to be found, and it is to make use of them that fire-leaders have to be trained.

Rifle Fire Defence.

The ground, therefore, has a great influence upon the defence of a position by rifle fire, and determines the type of position to be selected for defence. Of the stream of bullets sent out from a single machine gun or the rifles of a company, the best directed fifty per cent. furnishes a nucleus of the action of fire. Rather more than fifty per cent. of the bullets are effective from the point of view of beating ground, but not of killing the enemy.

With fairly good shots and with rifles recently tested and directed by a good fire-leader, about 75 per cent. of the bullets will fall within the really effective area. There will be a certain spreading out of the nucleus by the creation of a larger dangerous area on downward slopes. With ground which slopes upward from the line of sight, it follows that if a company is forced to occupy a position with rising ground near it, the leader cannot hope to develop any very great fire effect against the enemy while the latter are descending the slope. On the other hand, the enemy while on the top of the slope cannot develop any great fire effect against the company because their fire will of necessity be a more or less plunging one on account of the downward inclination of the line of sight, and a plunging fire gives so small a dangerous area that it is likely to do but little damage.

It is recognized with all the influences which exist to make ranging difficult, that it is practically impossible for any man, however skilful, to judge the proper range at which to set his sight. Although he may judge the distance perhaps within a hundred yards, that will not help him much if the range is 2,800 yards where there is a fall of about 137 feet in the last 100 yards of the bullet's flight. It is not only difficult to get the exact range, but also to get the barometric and temperature effect of the air. To overcome these difficulties, a device known as "combined sights" is adopted—that is, making part of the firing machine fire at one range, and part at another, say half a company at 1,400 yards and half at 1,550, which spreads the nucleus of the fire zone.

"Combined Sights" Device.

With accurate ranging, the nucleus of the beaten zone will fall within the required area, but without such accurate judging there will be no effective beating of ground where it is required, or the nucleus may only touch the edge of the required area with too thin a shower of bullets to do real damage. It is therefore frequently necessary to use combined sights, so as to get a greater searching power and depth in the zone of fire. In searching ground, the same aiming mark is used throughout one search, but the range is progressively increased or decreased, so that a strip of ground is beaten for perhaps a mile in depth and then another strip is beaten, and so on until the whole ground is searched in strips.

Similarly, sweeping may be carried out by changing the direction of fire crosswise—or searching may be combined with sweeping—so that if there are four companies in action, two are searching and the other two sweeping, two working fore and aft and two working backward and forward across the front allotted to them. In this way the greatest possible psychological effect that fire can produce is obtained. A dropping fire does not disturb men very much after the first few minutes because so few men get hit and there is so long an interval between hits that no one gets nervous, whereas, if heavy fire is brought to hear with a sudden rush on one part of the line and suddenly switched to another, each bit of the line struck by the gust of fire is not only materially damaged but the men are also correspondingly distressed, which puts their shooting out more rapidly than anything else. When men are demoralized by heavy casualties around them their shooting is likely to be very poor.

After all this long range and collective

firing practice, the training in the British army has another feature, viz., individual snap-shooting. Suppose that men are attacking a position and have fought their way forward under the command of their fire-leaders until they have reached a position of say 200 to 250 yards from the enemy, at which point they are unable to advance further because any man who stands up is immediately shot. It is at such critical stage of the attack that a special phase of the battle develops. It is the crisis of fire, and has for its object the winning of either material or psychological superiority for one side or the other, in order that one of the forces may charge home and close with the bayonet.

Rapid, Accurate Fire at Short Range.

At short range, material as well as psychological superiority is gained by putting the fear of death into every man on the other side every time he moves, and that can be done only by extraordinarily rapid shooting with extreme accuracy, so that every time an enemy's head appears around a stone, through a loophole or over a cover, it is at once greeted with a stream of bullets all around him. Once the enemy's head can be kept down in this way there is nothing to stop the bayonets—and it is with the bayonet that the decisive results can be obtained. An effort is made to get the troops so close to the enemy that they can use this rapid and accurate short range fire to which they are trained. In short range fighting the men have to act individually because there is no time or opportunity for any command. They fire whenever possible and when the fire-leader has got his men to that position and feels that they will win moral superiority he is ready to make his final plans to close with the enemy.

Such, then, are the ideas which have been the basis of training of the British regular army in the last few years. The actual course of training is of extreme interest. At the great ranges at Hythe there are thousands of dummies which can be moved with great realism in almost any direction and at almost any speed. Even dummy cavalry can appear, gallop across the plains and charge. Guns appear and gallop into position, and the whole range is really a maze of mechanical devices to secure the movement of different sets of dummies.

The Dummy Feature of Training.

One of the most interesting features there shown, is a small position definitely prepared for defence by a hundred men. In front of that position, extending for about 300 yards, is ground over which dummies are arranged to advance and attack. As a demonstration a hundred really good shots are selected and instructed to hold the position while they are attacked by the dummies, and each given 150 rounds of ammunition. The dummies begin to come forward in definite infantry attack formation from the extreme limit of the range. The attack develops and is pressed home. As a rule, the dummies are practically untouched, and the men who defend the position, these good target shots, are in a condition bordering upon physical collapse from fatigue after trying to fire 150 rounds with extreme rapidity.

The continual discharge of the rifle is very fatiguing in itself. Rapid rifle firing after 100 rounds is no joke becase the barrel gets very hot and the kick very savage. As a contrast a series of recruits from a line regiment, who have done no firing, except at short ranges, but have been carefully trained in parade and field in recognizing targets and snapping without firing, are placed under command of five good fire-leaders. One of the fire-leaders is a company commander, and the other four are section commanders. These much poorer shots, not through any virtue or merit of their own, but through the skill of the firing commanders, are able to inflict hits upon between 70 and 80 per cent. of the dummies in attack. That, of course, would not be reproduced in a real attack, because the enemy would be firing at the holders of the position, and the fact of being fired at has, with all but the most experienced veterans, a certain disturbing effect. It is, nevertheless, wonderful how little difference it makes to men after a few days.

Close Order—Effect of Rifle Fire.

The next practice for demonstration is intended to prevent mistakes in formation, and shows the effect of rifle fire upon troops in close order. A series of screen are put up to represent a battalion in quarter column, with its eight companies close together. A party of green shots led by an experienced fire-leader have to deploy into position about a mile away from the screens. Sitting amongst these screens in little metal beehives, closed against the fire, but open on the other side, are the officers to be instructed. Firing is opened under direct instructions as to range, and 100 rifles working their hardest for a minute means that about 2,000 bullets are dropped in the striking area in 60 seconds.

To sit in one of these beehives is a liberal education, for before the reports of the rifles are heard the ground begins to boil. Stones jump and smash through the screens with the whizzing of bullets, and then the noise of the firing comes, and within a minute all the screens are wrecked, the poles are smashed, and everything comes to pieces. The same experiment repeated with good shots without fire-leaders in the same circumstances, is also instructive. Usually nothing happens, the men apparently judge the distance wrongly and, breathing fast after a rapid advance are not able to hold their rifles steady on the target. It is through such practical demonstration that infantry officers and men in the British Army are trained.

General.

No attempt has been made in this paper to elaborate points in connection with the use of the rifle, but simply to indicate in a general way the lines along which the British army is trained and along which all the forces of the British Empire are asked to train themselves, although many of them have not as yet responded to that invitation.

There are still men who are in the position of leaders of troops who hold out for long-range target shooting as though it had proved to be of real value in the field, whereas it has been found in actual service to be of almost no value at all. It is excellent elementary practice, teaching a man how to handle his rifle properly and keep it steady. The British War Office has been seeking to get the competitors at Bisley to agree to a complete change in the type of competitions, introducing service conditions, and it is only because the men who are interested in "pot hunting" do not understand the more serviceable type of shooting that an agreement has not yet been reached.

Of course the war has stopped this discussion, but unfortunately it has not stopped the results of the different types of training. There are troops with the Allies who have been trained on the old theory that everyone must be a good target shot to be useful, and in the idea that the officers have comparatively little to do with the shooting; whereas the officers, n.c.o's, and squad-leaders who control the fire are really the men responsible for the shooting of the whole machine.

Kitchener and the Office Boy.—An amusing story has been going the round of the Tyne shipyards concerning the recent visit of our King, accompanied by Earl Kitchener, to certain local works. The Royal party was in the drawing office of a celebrated firm on one occasion, when the door opened somewhat noisily, and a youth entered, apparently in ignorance of the presence of the visitors. "You are not one of the draughtsmen, are you?" inquired his lordship of the newcomer. "No, sir, I am the office boy," was the reply, given with such an air of self-importance that the habitually stern face of K. of K. relaxed. Turning to the King, the War Lord gravely exclaimed, "Your Majesty, the office boy."

PRODUCTION METHODS AND DEVICES

A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

CHATTERING TAPER REAMERS.

By J. C. Klaehn.*

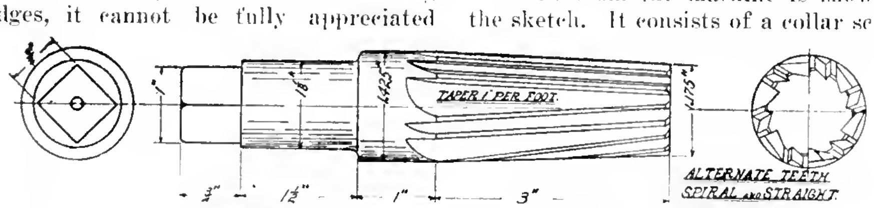
THE writer was much interested in your article in the June 17, 1915, issue of Canadian Machinery, page 519, on "Chattering Taper Reamers," from Herbert's Monthly. No doubt all that was said will be quite readily agreed to by those who have attempted to produce large numbers of reamed taper holes, which had to be perfectly smooth and accurate.

Recently the writer had a large quantity of taper holes to be reamed in brass castings, which were used as quick-make-and-break couplings on a compressed air system. These couplings had to be interchangeable, thus grinding to fit in pairs was out of the question.

From previous experience with the standard taper reamer, I knew that it would not do very satisfactory work, and, if possible, I wished to use power for operating the reamers, as considerable material had to be removed. The accompanying sketch shows the reamer we adopted for this work.

You will note that spacing of the teeth is quite coarse, being quite reverse to the usual practice, but quite necessary for rapid removal of stock.

The main feature of the design of this reamer is in the alternate straight and spiral or "backward" teeth. This prevents the reamer from "hogging in," and permits power to be used to drive it. The holes that these reamers produce are as smooth as can be desired, and unless a person had actually tried one of them into a reamed hole by hand, and felt the velvety action of its cutting edges, it cannot be fully appreciated that for a taper reamer, alternate straight and "backward" spiral cut teeth certainly seem to be the correct design.



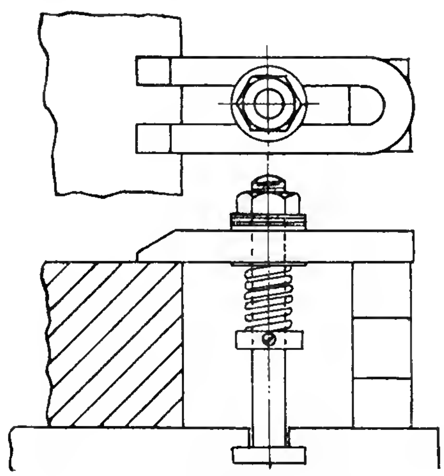
LARGE SIZE "B. & S." TAPER COUPLING REAMER.

*Master Mechanic, Can. Consolidated Rubber Co., Berlin, Ont.

A STRADDLE-CLAMP SUPPORT.

By J. E. Cooley.

ON planers, millers, and other machines where straddle-clamps are used to strap down work, a great deal of time is lost through what might be called a "wasteful method" in handling these tools. Where several of these clamps are used together, and each one is removed from the bolt and work and thrown on the floor or dropped down somewhere after an operation is completed, it is readily seen how wasteful this proceeding is. There is seldom any need to remove the straddle-clamp entirely away from the bolt, or let it even drop down, in order to remove the work from the machine. It is only necessary to provide some means to keep the clamp upheld, so that it can be drawn back sufficient to clear the work.


COLLAR AND SPRING FOR STRADDLE CLAMP.

A useful time-saving suggestion by which a straddle-clamp can be kept in position while work is being placed or removed from the machine is shown in the sketch. It consists of a collar screwed on the bolt a suitable distance below the clamp, on top of which is placed a spring and washer as shown. It is readily seen that when the nut is unfastened, the spring causes the clamp to lift up, so that it can be drawn back from the work.

One length of spring can be used for different lengths of bolts, it being only necessary to set the collar so that the spring will have a slight tension under the clamp after the nut is unloosened.

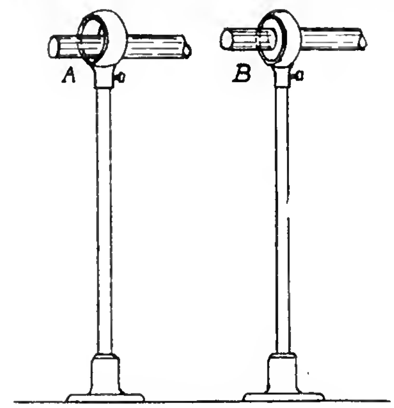
UNNECESSARY NOISE IN MACHINE SHOPS.

By E. C.

A GREAT deal of the noise made in machine shops is unnecessary. In order to produce good work, and in order that workmen shall not have their attention attracted away from same, it is important to eliminate as much as possible all unnecessary noise. While all noise cannot be entirely done away with, it is possible to reconstruct some of the means that produce it so that the sounds will be considerably lessened.

Attention is called to the unnecessary noise made in having bar-stock run loosely in the upright supports that are fastened to the floor near the ends of screw machines and turret lathes. Everyone is familiar with the rattling and banging noise produced, especially when the speeds are changed or reversed, as required in running a die off a thread.

This noise is caused by using only one size stock-holder, in order to take in all the different diameters of stock in one machine. An example of this is shown in the illustration at A. If separate stock-holders are used with holes of the same diameter as the bar-stock, as suggested at B, this noise would be greatly reduced. The holder is fastened to the rod by means of a set screw. Several of these holders could be made up and marked, and kept together in a box always ready for use.



LOOSE RUNNING BAR STOCK.

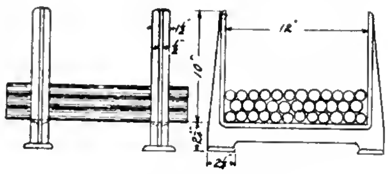
SHAFT RACKS.

By C. James.

WHEN piling small shafts on a work bench the general method is to stack them up pyramid fashion, supporting them on the sides by means of nails or pointed rods driven into the bench. This method is not always dependable, as the

nails or rods often give way, letting down the shafts with a great noise and confusion. Another objection is that more space is taken up than really necessary.

In the enclosed drawing is shown a neat and reliable arrangement for holding a considerable number of shafts in a limited space. It consists of two light yet substantial cast iron racks, that are



SHAFT RACKS.

"stood up" near each other on the work bench, the shafts being placed across them as shown.

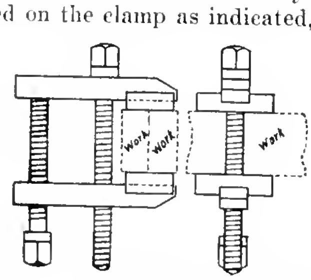
The racks as seen in the drawing are made up to hold 100 shafts of 1-in. diameter in a space of 10 in. by 12 in.

GROOVED BLOCKS FOR HOLDING WORK PARALLEL.

By J. Hartford.

IN making a jig or doing any accurate tooling, it is sometimes necessary to hold two pieces of work together parallel for the purpose of drilling or filing them, etc. For this means two steel blocks are placed against the work and fastened on with a parallel clamp.

In manipulating the blocks, they often slip away and fall to the floor, or they are not placed satisfactorily in the clamp after the screws have been drawn up. In the illustration is shown a useful "kink" that may be of interest to machinists. It consists of cutting a groove in the blocks so that they can be slipped on the clamp as indicated, thereby keeping them from falling from the clamp, and maintaining them in an upright position when the screws are tightened.

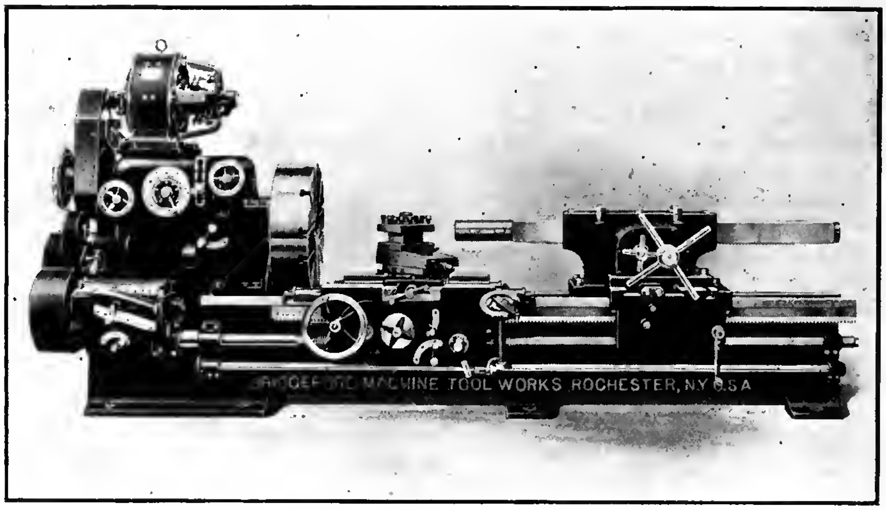


GROOVED BLOCKS FOR HOLDING WORK PARALLEL.

TURNING AND BORING LATHE FOR LARGE SHELLS.

IN order to meet the demand for machinery for the rapid production, both in turning and boring of large shells, the Bridgeford Machine Tool Works of Rochester, N.Y., have taken their 32-in. heavy pattern triple-geared head engine lathe and arranged it with devices that permit of maximum production up to the limit of the best high-speed steels. The lathe is up-to-the-minute in design, is a powerful, well-built tool, and, on a 32-in. diameter, delivers a pulling power of approximately 17,800 lbs. at the tool.

A power-fed tail block of massive construction can be supplied, which makes the boring of large shells a simple and rapid operation. The bar, which is $5\frac{1}{2}$ in. diameter, and bored and reamed for No. 7 Morse taper, is arranged on a swivel so that either straight or taper holes can be bored without using the taper attachment. The power for operating the bar is taken from the lead screw and transmitted to the bar through gearing. In addition to the power feed, there is an arrangement whereby the bar can be traversed by hand, either slow or fast, as desired by the operator. The large handwheel has two positions—one for fast movement, and the other through back gears. The small handwheel is for engaging or disengaging the power feed. There is cross adjustment for the tail block, also lateral adjustment along the bed. A four tool steel turret on the compound is of great assistance in the rapid and economical handling of the work.



TURNING AND BORING LATHE FOR LARGE SHELLS.

The lathe shown is driven by a 18 h.p. Westinghouse variable-speed motor, and controlled from the carriage by the use of a Westinghouse drum-type controller, which is placed on the rear of the frame. This enables the operator to control the motor from the carriage and change from slow to fast speed or vice versa, without leaving his position at the carriage. Without a motor the head block gives fifteen mechanical speed changes in geometric progression, but when the lathe is equipped with variable-speed motor drive, these fifteen speeds are multiplied by as many points as there are on the controller. The quick change gear box enables the operator to obtain instantly any desired feed.

A number of firms with these lathes in operation have, we understand, equipped them with side turning or full swing rests, and, when so equipped, they are able to take care of large shells to the best possible advantage.

OIL IN MOTOR WINDINGS.

By A. F. Adams.

ON a 400 h.p. induction motor we have had considerable trouble with oil getting into the stator windings. The oil apparently worked out around the plugs, inserted in the bottom of the oil well for draining the bearings, and also around the connection, where the gauge glass is placed.

Several times the plugs had been taken out and cleaned, and, as the threads in the castings were in good condition, also those on the plugs and gauge glass connections, they were replaced. Each time that this was done, however, the leakage seemed worse, drops of oil would form on the bottom of the bearing and on the outside, and, due to the current of air which was generated by the fans of the rotor, a portion of the drop of oil would be deposited on the windings.

As something had to be done, we scraped the paint off of the casting where the plug and gauge connections were and found our trouble. A portion of the casting seemed to be porous, and this was where our oil was coming from and not from the drain plug and gauge connection as had been supposed.

We successfully stopped the trouble by putting a piece of condenser tube packing around the plug and leading it to the floor. All of the oil goes down the string, and the windings are perfectly dry. Any piece of soft cord will answer the same purpose.

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

VAULT FEATURE, DOMINION BANK BUILDING, TORONTO

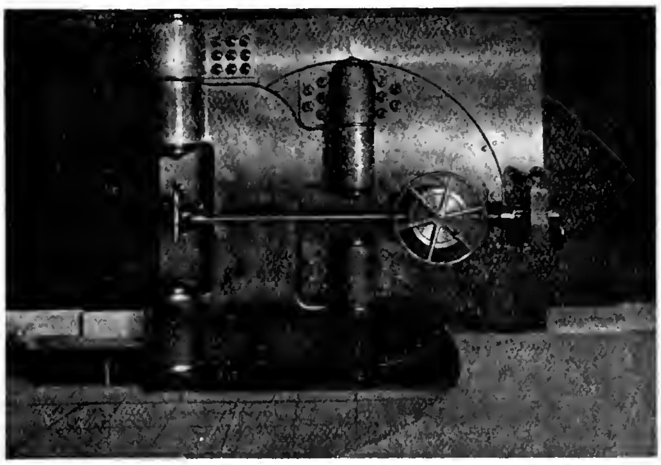
NOT the least attractive feature of the many such to be formed in the design construction, equipment and appointments of the new Dominion Bank situated on the south-east corner of King and Yonge Streets, Toronto, is the great vault, admitted to be the largest as well as the most complete in Canada. The approach is by the broad marble stairway leading from the savings bank department down to the public space separated from the vault lobby by a massive steel grille with bars one and one-half inches thick, spaced four inches on centres, and reaching from the floor to ceiling. The vault is erected entirely separate from the building construction, and is approximately 33 feet square by 25 feet high; divided into two stories, the upper or safe deposit vault, the lower or treasury vault.

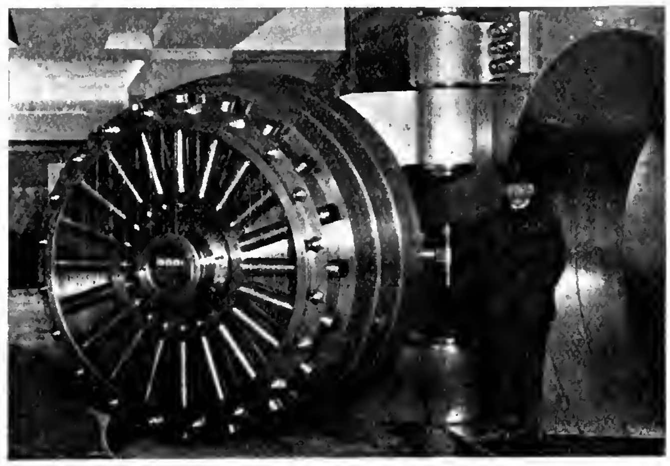
Protective Devices

Surrounding the vault is a patrol passage 3 feet in width. At the corners are placed heavy silvered glass mirrors, full depth, and set at such an angle as to permit of free observation on all sides; while similar arrangements have been made above and below, so that no exposed surface escapes the attention of the guard. Lights with silvered reflectors are arranged by means of removable parts so that the entire length of the observation space is well illuminated. Even the bottom of the vault is constructed in such a manner as to remove all possibilty of tunneling. Upon the solid rock-bed, 18 inch steel beams encased in concrete form a series of piers which support the vault, and at the same time permit an unobstructed view of all open space beneath.

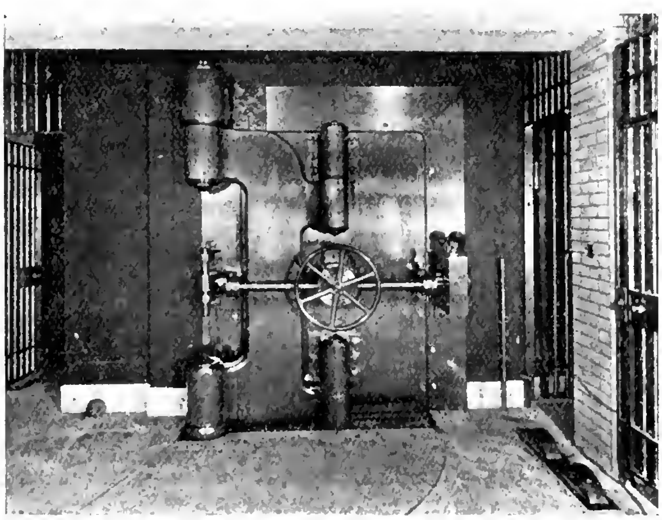
Directly over the observation tunnels just mentioned is a 28 inch floor, the construction of which consist of reinforced concrete, closely staggered iron grillage, $2\frac{1}{2}$ inch steel lining, and tile laid upon a cement base. The walls also are similar in thickness to the floor, built up of $2\frac{1}{2}$ inches of shock and drill-proof steel surrounded by 2 feet of rock concrete. This concrete is made impervious to fire, shocks and acid applications by having two rows of heavy steel beams embedded within. The entire outside surface of laminated lining is waterproofed by two layers of heavy tar paper with applications of hot tar on both sides.

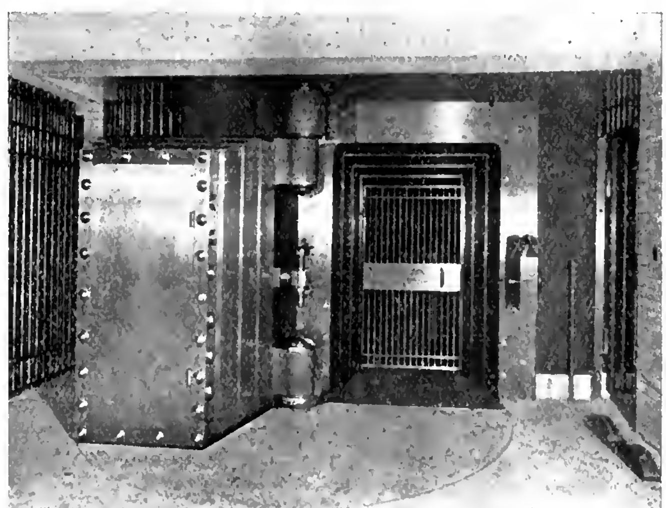
To enter the safe deposit vault it is necessary to pass through one of the





TWO VIEWS OF CIRCULAR DOOR TO SAFETY VAULT, DOMINION BANK HEAD OFFICE BUILDING, TORONTO





TWO VIEWS OF ENTRANCE DOOR TO TREASURY VAULT, DOMINION BANK HEAD OFFICE BUILDING, TORONTO.

largest and heaviest doors ever built. It is circular in shape, $2\frac{1}{2}$ feet thick, weighs more than 30 tons, and has a clear opening of 7 feet 6 inches in diameter. The door guarding the treasury vault below is of the same thickness and construction, but rectangular in shape.

The doors are of composite construction, the outer half formed of low steel castings containing 10 inches of concrete; interlaced refractory steel members $1\frac{1}{2}$ inches in diameter, by 4 inches on centres; and an outer burner proof metallic section. The inner half is built up of seven parts each of 2 inch thickness firmly welded together; three layers of five-ply chrome steel plates; four layers of low steel and solid cast steel bolt frames. With the exception of two narrow rebates, there is no short stepping and no customary tongues and grooves.

Lock Mechanisms

A feature of unusual interest is the locating of the combination locks and bolt-throwing mechanism on the door jambs and the time locks upon the doors proper. The arrangement necessitates the putting of holes through both the jamb and the door in order to reach the dogging devices in burglar operations and provides doors solid and without spindle holes. All locks and bolt-throwing mechanism are covered with heavy steel plates, while the combination dial is in shape of a steel cylinder disappearing angle-wise in the top of the front pressure housings. The front end is provided with an oval glass window, behind which appears an electrically illustrated dial with two revolving pointers which are connected with operating knobs located on the side of the housing, used to set the combinations of the locks. The device is not only one of convenience, as the cylinder is located upon a normal line of vision, but absolutely prevents any unauthorized observation of the setting up of the combination numbers.

The doors are hung upon massive steel crane hinges provided with ball and roller bearings and so carefully balanced that they are easily manipulated. They are steam tight and locked with a train of twenty holding bolts, $4\frac{1}{2}$ inches in diameter. The bolt work is covered with sections of French plate glass, at the centre of which is a circular glass door 15 inches in diameter. The outside ring of glass is one piece without radial frames, set with a grey invisible packing.

A special foundation of concrete has been set in front of the entrances for the support of the mechanism, whereby sections of the floor are dropped by the use of a hand lever to permit the opening and closing of the doors and then raised and locked in position to complete the floor levels.

Electric protection has been installed so that in case any attempt has been made to drill through the walls or doors, or should the doors be opened in any unauthorized way, three large gongs sound an alarm, one being located upon the exterior and two upon the interior.

Safety Deposit Vault Equipment

The safety deposit vault is equipped with more than a thousand boxes of various sizes, finished in polished steel, locked with the latest interchangeable key locks, and provided with an enamelled bond drawer. The vault has a polished steel grille and gate located directly within the main vault entrance. The floor is tiled with marble slabs, the joints being "struck" with monel metal bars. The walls and ceilings are panelled with steel plates and bars, and the lighting is furnished by a double system of electric equipment so arranged that the vault cannot be thrown into darkness by anyone except the proper officials.

Within the vault is a telephone which allows a means of outside communication by any person accidentally locked in at night time. If such an accident should occur the prisoner will find a pair of lights burning and a card of instructions advising whom to call and how to release the time lock devices, after which the combinations can be operated. Large volumes of fresh air are constantly delivered into the vault, the circulation of which is augmented by fans.—Cuts Courtesy of "Construction."

SEVEN MISTAKES OF LIFE.

Here is an American editor's enumeration of the seven mistakes of life:

1—The delusion that individual advancement is made by crushing others down.

2—The tendency to worry about things that cannot be changed or corrected.

3—Insisting that a thing is impossible because we ourselves cannot accomplish it.

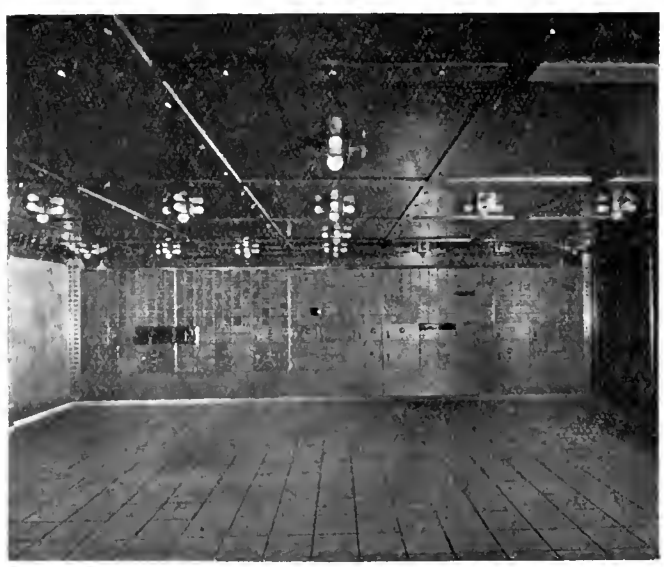
4—Attempting to compel other men to believe and live as we do.

5—Failure to refine the mind by acquiring the habit of reading good literature.

6—Refusing to set aside trivial preferences in order that important things may be accomplished.

7—The failure to establish the habit of saving money.

STEEL GRILLE IN FRONT OF SAFETY VAULT.



INTERIOR OF SAFETY DEPOSIT VAULT.

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THE WAR A TEST OF ENGINEERING SKILL AND CAPACITY.

WE are now into the twelfth month of the war and evidences are not lacking that its duration will be at least as long again. A feature of it, however, that seems to have been given little consideration relates to the part our Empire has played and is still playing by virtue of its having become one of the combatants.

In submitting the view, that, long ere this, Germany would have over-run the whole of Europe and have become a menace to world freedom, but for British intervention on behalf of the latter, expression is given to the thoughts and ideas of all who have followed the course of events in the various theatres of conflict since last August. Too sanguine expectations, seem, however, to have been formed as a result of our entry into the conflict—in a word, too much seems to have been taken for granted in the matter of our preparedness to make a swift and effective onslaught on our enemy and all too little was known of his highly developed fighting machine, its engineering supplement and mainstay.

When the inside history of the war comes to be written, it will be found that resourcefulness and deeds of valor or far-flung battlefields—of the type and nature chronicled in other conflicts, sea and land, may have to give pride of place for the first time to engineering expertness, ingenuity and constructive ability. In a word, the requirements of any combatant nation are, if success is to be attained, that the industries of that nation, and particularly those relating to engineering and metal-working be enlisted and mobilized for service. Mobilization of industry did not materialize in Britain with that of her standing army and her fleet, although now it is realized that such a step should have been taken. The man as in the past was reckoned to still have implanted in his nature grit superior to that of any adversary and to be at least a match.

Among other things these months of war have taught us, however, is that individual men in even overwhelming numbers are only of value when supported by the products of our workshops and factories. We need, it is true, all the men we can get, and we want a great many more to offer themselves; incidentally this is a particularly pressing matter with us to-day in Canada. We need more than men, however, we need engines and munitions of war, but as in the case of the Motherland, we have gone into the manufacture of these in that more or less spontaneous, unsystematic manner that marks our race.

As has been said, there was no Imperial command to put every lathe, tool and forge at the service of Empire. We simply have taken advantage of the opportunities afforded of Government work, realizing that thereby we were helping out in the task of suduing Germany, and incidentally helping ourselves. We have been manufacturing shells and having had several months practical experience of the work, we had got to the stage at which not a little pardonable pride was being taken in our achievement, but our shell products, although as called for, are incomplete for service. We are now asked to make them so, it only being realized at this late day that shipping empty shells either to Britain or France is a clumsy, uneconomical and unbusinesslike proceeding.

Compared with our shell forging and machining plants, those equipped for adding the "fixed ammunition," are away less than a handful. Wherever the blame for the present state of affairs may be placed, much unnecessary heart-burning and confusion is likely to result in our shell shops. Sufficient enterprise should have been shown by our Department of Trade and Commerce to make suggestion to the British War Office that our Canadian plants were both equal to the task and were prepared to furnish shells ready for the gun batteries.

Canada would have been unanimously at its back if it had demanded from Lord Kitchener why orders for millions of completed shells should not be given to our manufacturers. If Schwab, with the United States Consular service at his back, could sell to the British War Department, why could not Foster do the same thing with Canada at his back? Obviously we need a business, not a political engineer at the head of our Trade and Commerce Department.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

	Montreal.	Toronto.
Grey Forge, Pittsburgh	$13 20	$13 45
Lake Superior, charcoal, Chicago	.....	15 75
Ferro Nickel pig iron (Soo)	.....	25 00
Middlesboro, No. 3	21 00	.....
Carron, special	22 00	.....
Carron, soft	22 00	.....
Cleveland, No. 3	21 00	.....
Clarence, No. 3	21 00	.....
Glengarnock	25 00	.....
Summerlee, No. 1	25 00	.....
Summerlee, No. 3	25 00	.....
Michigan charcoal iron	25 00	.....
Victoria, No. 1	21 00	19 00
Victoria, No. 2X	21 00	19 00
Victoria, No. 2 Plain	21 00	19 00
Hamilton, No. 1	20 00	19 00
Hamilton, No. 2	20 00	19 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	2.15
Steel bars, f.o.b., Toronto	2.15
Common bar iron, f.o.b., Montreal	2.15
Steel bars, f.o.b., Montreal	2.15
Bessemer rails, heavy, at mill	1,25
Steel bars, Pittsburgh	1.25
Twisted reinforcing bars	2.15
Tank plates, Pittsburgh	1.25
Beams and angles, Pittsburgh	1.25
Steel hoops, Pittsburgh	1.30

F.O.B., Toronto Warehouse.	Cents.
Steel bars	2.10
Small shapes	2.35

Warehouse, Freight and Duty to Pay.	Cents.
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ¼ to ½ in., 100 lb.	$2 35	$2 25
Heads, per 100 lb.	2 55	2 45
Tank plates, 3-16 in.	2 60	2 45

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$12 50	$12 50
Copper, crucible	14 50	14 50
Copper, unch-bled, heavy	14 00	14 00
Copper, wire, unch-bled.	14 00	14 00
No. 1 machine, compos'n	11 50	12 50
No. 1 compos'n turnings	10 50	9 25
No. 1 wrought iron	6 00	6 00
Heavy melting steel	5 75	6 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings	12 00	12 00
No. 1 brass turnings	10 00	10 00
Heavy lead	4 50	5 00
Tea lead	$ 3 50	$ 3 75
Scrap zinc	12 00	14 00

W. I. PIPE DISCOUNTS.

Following are Toronto jobbers' discounts on pipe in effect June 25, 1915:

	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
Standard				
¼, ⅜ in.	63	32½	....	....
½ in.	68	41½	....	....
¾ to 1½ in.	73	46½	....	....
2 in.	73	46½	69	42½
2½ to 4 in.	73	46½	72	45½
4½, 5, 6 in.	....	....	70	43½
7, 8, 10 in.	....	....	67	40½
X Strong P. E.				
¼, ⅜ in.	56	32½	....	....
½ in.	63	39½	....	....
¾ to 1½ in.	67	43½	....	....
2, 2½, 3 in.	68	44½	....	....
2 in.	....	....	63	39½
2½ to 4 in.	....	....	63	42½
4½, 5, 6 in.	....	....	66	42½
7, 8 in.	....	....	59	35½
XX Strong P. E.				
1½ to 2 in.	44	20½	....	....
2½ to 6 in.	....	....	43	19½
7 to 8 in.	....	....	40	16½
Genuine Wrot Iron.				
⅜ in.	57	26½	....	....
½ in.	62	35½	....	....
¾ to 1½ in.	67	40½	....	....
2 in.	67	40½	63	36½
2½, 3 in.	67	40½	66	39½
3½, 4 in.	....	....	66	39½
4½, 5, 6 in.	....	....	63	36½
7, 8 in.	....	....	60	33½

Wrought Nipples.

4 in. and under	77½%
4½ in. and larger	72½%
4 in. and under, running thread.	57½%

Standard Couplings.

4 in. and under	60%
4½ in. and larger	40%

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65%
Sq. Head Set Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45%
Flat & But. Head Cap Screws	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in. N.	70%
Semi-Fin. Nuts up to 1 in.	70%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

METALS.

	Montreal.	Toronto.
Lake copper, carload	$21 50	$21 50
Electrolytic copper	21 25	21 25
Castings, copper	21 00	21 00
Tin	45 00	46 00
Spelter	28 00	28 00
Lead	7 50	7 50
Antimony	40 00	40 00
Aluminum	40 00	40 00

Prices per 100 lbs.

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh	$20 00
Openhearth billets, Pittsburgh	20 00
Forging billets, Pittsburgh	25 00
Wire rods, Pittsburgh	25 00

NAILS AND SPIKES.

Standard steel wire nails, base	$2 40	$2 35
Cut nails	2 50	2 70
Miscellaneous wire nails	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	75
Stove bolts	80
Plate washers	40
Machine bolts, ⅜ and less	70
Machine bolts, 7-16 and over	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes	4¼c per lb. off
Nuts, Hexagon, all sizes	4¾c per lb. off
Iron rivets	72½ per cent.
Boiler rivets, base, ¾-in. and larger	$3.25
Structural rivets, as above	3.25
Wood screws, flathead, bright	85, 10, 7½, 10 p.c. off
Wood screws, flathead, Brass	75 p.c. off
Wood screws, flathead, Bronze	70 p.c. off

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Standard. Price. per ft.	Extra Strong, Sizes Ins.	Extra Strong, Price per ft.	D. Ex. Strong, Size Ins.	D. Ex. Strong, Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.....
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....

COKE AND COAL.

Solvay Foundry Coke	$5.75
Connellsville Foundry Coke	4.85-5.15
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

IRON PIPE FITTINGS.

Canadian malleable, 40 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 75; malleable, lipped unions, 65.

MISCELLANEOUS.

Putty, 100 lb. drums	$ 2.70
Red dry lead, 100-lb. kegs, per cwt.	9.67
Glue, French medal, per lb.	0.18
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.18
Benzine, single bbls., per gal.	0.18
Pure turpentine, single bbls.	0.66
Linseed oil, raw, single bbls.	0.73
Linseed oil, boiled, sinble bbls.	0.76
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Lead wool, per lb.	0.09
Pure Manila rope	0.16
Transmission rope, Manila	0.19½
Drilling cables, Manila	0.17½
Lard oil, per gal.	0.60

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto 40%

PROOF COIL CHAIN.

¼ inch	$8.00
5-16 inch	5.35
⅜ inch	4.60
7-16 inch	4.30
½ inch	4.05
9-16 inch	4.05
⅝ inch	3.90
¾ inch	3.85
⅞ inch	3.65
1 inch	3.45

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	60
Carbon over 1½ in.	25
High Speed	40
Blacksmith	60
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Centre	25
Pipe Reamers	80

Discounts off standard list.

COLD DRAWN STEEL SHAFTING.

At mill	Price list withdrawn.
At warehouses	

TAPES.

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3.50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$3 00	$3 00
Canada plates, dull, 52 sheets	3 10	3 50
Canada plates, all bright	4 25	4 50
Apollo brand, 10¾ oz. galvanized)	6 40	6 40
Queen's Head, 28 B.W.G.	6 50	6 50
Fleur-de-Lis, 28 B.W.G.	6 30	6 30
Gorbal's Best, No. 28	6 50	6 50
Viking metal, No. 28	6 00	6 00
Colborne Crown, No. 28	6 30	6 30

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$10 00	.....
1¼ in.	10 00	.....
1½ in.	10 00	.....
1¾ in.	10 00	.....
2 in.	10 50	9 20
2¼ in.	12 10	.....
2½ in.	13 05	12 10
3 in.	15 75	12 70
3¼ in.	.....	13 90
3½ in.	20 00	15 00
4 in.	25 50	18 90

Prices per 100 feet, Montreal and Toronto.

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50 & 10%
Standard	60%
Cut leather lacing, No. 1	$1.25
Leather in sides	1.00

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	$9.00
¼ in.	6.25
5-16 in.	4.65
⅜ in.	4.00
7-16 in.	4.00
½ in.	4.00

Prices per 100 lbs.

WASTE.

WHITE.	Cents per lb.
XXX Extra	0 10¼
X Grand	0 09¾
XLCR	0 09¼
X Empire	0 08½
X Press	0 07¾
COLORED.	
Lion	0 07⅛
Standard	0 06⅜
Popular	0 05¾
Keen	0 05¼
WOOL PACKING.	
Arrow	0 16
Axle	0 11
Anvil	0 08
Anchor	0 07
WASHED WIPERS.	
Select White	0 09
Mixed Colored	0 06¼
Dark Colored	0 05¼

This list subject to trade discount for quantity.

BELTING RUBBER.

Standard	50%
Best grades	30%

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., July 5, 1915.—The demand for machine tools of all kinds, particularly engine and turret lathes, continues very brisk with deliveries promised three months from date of placing order. In this line there is a wider and more promising outlook than appears at first sight. For example, with the pressure to which machine tools are being subjected, the night and day shifts, coupled with the added incentive of piece-work prices, the life of equipment at present in use will not be of long duration. In other words, even in plants now fully equipped, there will be a steady and consistent demand for new machine parts and also complete machines.

Just at present, according to some machine tool users, there is great opportunity for the manufacture of lathes, shapers, presses and milling machines. On the other hand it is claimed that after the finish of the war there will be a glut of machine tools on the market. This latter argument is, however, refuted by the fact that even for the duration of the war most shops will have to renew their equipment units entirely.

There is not much difference in prices of electrolytic copper between New York and Montreal, the price in the former place being one cent a pound cheaper than locally. August deliveries are offered at 19¾c cash New York. The outlook is that the price of copper will con-

tinue to soar owing to increased consumption on account of war demands, it being highly problematical as to whether production will keep pace with the consumption. The opinion of leading military authorities seems to be in agreement that the war has yet two years to run. All this is more or less guesswork, however; at the same time there is considerable capital invested on the strength of such a long drawn out struggle. Finished steel prices have been extremely well maintained.

Antimony still continues at 40 cents a pound., which is a considerable increase from 7 cents, the ruling price in the ante bellum days. The demand in this country for antimony is large and persistent.

The price of tin has not shown any great variation in spite of the fact that consumption is fairly strong.

Aluminum is quoted at 40 cents, but buyers seem reluctant to pay this price. Bids of 38c have been made, but nothing seems to be available at that figure.

While metal prices generally have been rising steadily, the price of second-hand lead is quoted at 4½c, with more frequent offers and prompt deliveries. In fact, most all waste metals this week show a considerably easier feeling, with red brass and red brass turnings down one cent.

The recent flurry in spelter prices which, it is alleged in some quarters, were deliberately marked down to facilitate the purchase of low-priced concentrates by the very people who will be interested later in getting as high a price as possible for the refined product, did not have any lasting effect on the market. There was a rumor that manipulative tactics were being resorted to which caused the prices to remain firm. There is every evidence of a fresh buying movement being close at hand.

While no large contracts are yet being booked, there are many inquiries in the market. The way things are going, the "stand-patter" is about on an equal footing with the more venturesome. Just to demonstrate what the activity is in this metal, the New Jersey Zinc Co. has declared an extra cash dividend of 30 per cent. It is also rumored that their capital stock will be increased three and one-half times.

Toronto, Ont., July 6, 1915.—The development of foreign business and the manufacture of war equipment, including munitions, are the chief matters of interest in commercial circles. With ordinary business dull and little prospect of any material improvement for some time to come, there is every incentive for our manufacturers to look to other fields rather than at home. As regards this new feature, prospects are improving and it is anticipated that not only will further war orders be placed with Canadian manufacturers, but also orders for equipment not necessarily for the allied armies, but as a result of the war. The contracts for locomotives and cars already placed will no doubt be followed by others. Shells for the Russian Government are being made here and it is expected that manufacture of shells for the French Government will be commenced shortly. It is expected that the visit of David A. Thomas, the representative of the British Government, will result in large orders for war material being placed in Canada.

> **COMING CONVENTIONS.**
>
> **American Foundrymen's Association, Atlantic City, N.J.—Sept. 27-Oct. 1.**
>
> **Foundry and Machine Exhibition Co., Atlantic City, N.J.—Sept. 25-Oct. 2.**

Conrad F. Just, special Trade Commissioner for Canada to Russia, has sent an interesting report from Petrograd to the Department of Trade and Commerce. Mr. Conrad advises Canadian traders to organize on the basis of a close study of Russian requirements and to keep in touch with the consumer by means of local agents. He states that it is desirable to have assembling shops in Russia, particularly for machinery, thus effecting a saving on customs duties and permitting tendering on Government works.

Steel Market.

The mills have made an advance of $1 per ton on steel bars, plates and shapes, and quotations are now $1.25 f.o.b. Pittsburgh, with steel hoops at $1.30 at the same point. Canadian mills are quoting $2.15 f.o.b. Toronto and Montreal. Prices are very firm at the advance and may be raised again. The active demand for steel bars for shells continues with an increase in tonnage. Specifications for French shells have been issued and good business is expected from this source, as well as from Russia. Merchant business continues quiet, and statistics show a sharp decline in the building trade.

> **CANADIAN GOVERNMENT PURCHASING COMMISSION.**
>
> **The following gentlemen constitute the Commission appointed to make all purchases under the Dominion $100,000,000 war appropriation:—George Gault, Winnipeg; Henry Laporte, Montreal; A. E. Kemp, Toronto. Thomas Hilliard is secretary, and the commission headquarters are at Ottawa.**

Since the last advance in galvanized sheets, the spelter market has been easier but is recovering. Prices of sheets weakened, but are firm again and another advance is probable, as the spelter market is stronger. The continued abnormal price of spelter is affecting the output of galvanized sheets considerably. Some makers have withdrawn from the market entirely and others are asking higher prices for their product. Galvanized pipe is firm at the higher prices announced last week and makers are seriously affected by the spelter situation. Cold rolled strip steel has advanced $2 per ton. Prices on cold drawn steel shafting have been withdrawn pending an advance which it is expected will be about $2 per ton.

In the United States the steel market continues active and prices on all products are firm. Further large orders for ammunition are pending and there is a big demand for high-grade bars for shells. There is a better demand for steel plates owing to domestic consumption, and also on account of big business being done in the ship-building industry.

Pig Iron.

The market continues dull and the situation shows no improvement. Prices are unchanged.

Scrap Metals.

Quotations on copper and brass scrap are holding very firm on good demand. Scrap zinc has recovered and has advanced, being now quoted at 16c per pound. Lead prices are firm but unchanged. The market for iron and steel scrap is quiet and prices unchanged.

Machine Tools.

The market is distinctly quieter as regards new inquiries, but dealers are busy filling orders already placed. Deliveries are no better, the ingenuity of makers and dealers being taxed to satisfy customers so that they may begin operations with as little delay as possible. Second-hand machines tooled up for making shells are being requisitioned to make up for the deficiency in new equipment. There is a temporary lull as regards new shell contracts and also shipment of shell cases, but when plants of sufficient capacity for turning out fixed ammunition have been equipped, there will no doubt be increased activity in the shell industry and interesting developments may be expected.

Supplies.

The supply business is very good and prices are holding firm. The demand is principally from the shell plants, although ordinary business is showing some improvement. There are no price changes to note this week.

Metals.

There are few price changes to note in the metal market this week, for with the single exception of aluminum, which has advanced, all markets are steady. There is a big demand for this metal and supplies are scarce. The tin market has a weaker tendency, but the price is unchanged. Copper likewise is unchanged and the market stagnant. Spelter is firm at the advance announced last week and the situation shows no improvement. The lead market is weak but quotations generally are being maintained. The antimony market is dull, but the position of this metal is good. The New York metal exchange was closed on Monday.

Tin.—The market is quiet with a weaker tendency in London. The consumption of tin is on the increase and higher prices may result. Tin is quoted locally at 46c per pound.

Copper.—The situation is unchanged. The London market is lower due to the increase in stocks of copper in England and France, while the New York market is stagnant, and prices unchanged. The consumption of copper continues very heavy and will increase owing to the enormous demand for ammunition. The copper position is therefore a strong one and higher prices are looked for. Local quotations for copper are unchanged at 21½c per pound.

Spelter.—The situation continues serious and supplies are very scarce. Most of the demand is from the brass mills, but there is also considerable from galvanizers. The market is firm and unchanged with prices nominal at 28c per pound.

Lead.—The market is lower in London but firm in New York. Producers are well sold ahead, and the market has a steadier tendency. Locally, prices are holding firm and are unchanged at 7½c per pound.

Antimony.—The market is dull, but is holding up well. With the increase in the demand for ammunition, there will be a greater consumption of antimony. Quotations are unchanged and nominal at 40c per pound.

Aluminum.—The market is strong and has advanced again. There is a heavy demand for this metal, and supplies are very scarce. Aluminum has advanced 5c and is quoted at 40c per pound.

The Hudson's Bay Co. has been appointed purchasing agents in Canada for the French Government.

High Speed Steel Price.—Tungsten is one of the chief ingredients of high speed steels, its average being about 18 per cent. in every pound. As it has quite tripled in price within a short period, and is at that hardly obtainable, it was only reasonable to expect that the price of high speed steel would show a considerable and, of course, proportional increase.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Halifax, N.S.—The Starr Mfg. Co., have equipped their plant to make shells.

Truro, N.S.—The Truro Engineering Works, Ltd., have received an order for shells, and will proceed to install the necessary equipment.

Renfrew, Ont.—It is announced that the Smith mill owned by M. J. O'Brien will be converted into a machine shop and equipped with machinery for making shells.

Orillia, Ont.—The E. Long Mfg. Co. will undertake the manufacture of shells for the British Government. The initial order of 15,000 high explosive shells has been received.

Kingston, Ont.—A special committee of the city council have recommended that a boiler be purchased from the Jenckes Machine Co. for the proposed incinerator.

Welland, Ont—William G. Edwards of the International Specialty Co., is planning to equip the plant with machinery to manufacture shells for the French Government.

Calgary, Alta—The local branch of the Ford Motor Co. has secured an option on the property at the north-west corner of Eighth street west and Eleventh avenue, where it is planned to erect an assembling factory.

New Glasgow, N.S.—McNeil Bros., who are manufacturing shells, have leased the rink at Stellarton, which they will convert into a machine shop, in which shells and their parts will be made. New machinery costing $75,000 will be installed as soon as possible.

Municipal

Calgary, Alta.—The city is planning to build a big reservoir and a water filter.

Millardville, Ont.—The council are considering installing a waterworks system.

Collingwood, Ont.—The Town Council contemplate making improvements to the waterworks system.

The Pas Man.—A by-law will be submitted to raise $80,000 for the construction of a system of waterworks and sewerage.

Port Hope, Ont.—The by-law has passed authorizing an expenditure of $35,000 on waterworks improvements.

Whitby, Ont.—The completion of the sewer system is contemplated by the Town Council. A by-law will be submitted.

Kamsack, Sask.—The town council propose to construct an addition to the waterworks system, estimated to cost $35,000.

Lambeth, Ont.—The council propose to install a waterworks system, at an estimated cost of $15,000. Engineers J. A. Bell & Son.

Vancouver, B.C.—Seven by-laws for the purpose of raising three-quarters of a million dollars were defeated by the electors on June 28.

Matheson, Ont.—A by-law will be voted on by the ratepayers on July 16, to raise $20,000 to pay for the construction of a waterworks system.

Vernon, B.C.—The city council propose to install an auxiliary pumping station at B. X. Creek at a cost of $3,000. Ald. Clement is chairman of the Water Committee.

Hamilton, Ont.—By-laws have been passed by the City Council authorizing the issuing of debentures for $250,000 for the city's and owner's share of the McKittrick bridge and waterworks extension.

Mimico, Ont.—With the closing of the deal between the Villages of New Toronto and Mimico, for a supply of water to the latter municipality, the Mimico Council immediately intend to proceed with the work of laying the mains.

Toronto, Ont.—W. A. McLean, Provincial Highways Engineer, reports that the Toronto-Oshawa highway constructed of macadam would cost $239,000, and if made of concrete $625,000. The cost would be divided among the various municipalities interested.

The Pas, Man.—The town has given notice in the current issue of the Manitoba Gazette of its purpose to establish a system of electric light and power in its municipality at a cost not to exceed $50,000. The money will be raised by sale of debentures. The by-law will be submitted to the electors on July 15.

London, Ont.—The city council are considering awarding the following contracts for machinery for the Springbank pumping station:—Motors to Canadian Westinghouse Co., Hamilton, at $6,400; waterwheels to Hamilton Co., Peterboro, at $7,595, and pumps to the John MacDougall Caledonian Iron Works, Montreal, at $4,710.

ALLIES PURCHASING AGENTS.

The Trade and Commerce Department, Ottawa, has published the following list of purchasing agents for military purposes for the allied Governments:—

International Purchasing Commission, India House, Kingsway, London, Eng.

British.—Col. A. G. Barton and F. W. Stobart, Ritz Carlton Hotel, Montreal.

French.—Hudson Bay Co., 56 McGill Street, Montreal; Captain Lafoulloux, Hotel Brevort, New York; Direction de l'Intendance Ministere de la Guerre, Bordeaux, France; M. De la Chaume, 28 Broadway, Westminister, London.

Russian.—Messrs. S. Ruperti and Aieksieff, care Military Attache, Russian Embassy, Washington, D.C.

General Industrial

London, Ont.—The proposed breakwater at West London will probably be constructed of concrete.

Renfrew, Ont.—It is announced that the Jamieson Brick & Tile Co. will establish another plant here.

Owen Sound, Ont.—The Town Council has decided not to proceed with the scheme for building an elevator here.

Redcliffe, Alta.—A cyclone on June 25 did considerable damage to the planing mill here and several other factories.

Eburne Station, B.C.—It is announced that the B.C. Grinnell Glove Co., of Vancouver, will locate a branch of their business here.

Sorel, Que.—The factory of the Sorel Bottling Co., recently destroyed by fire with a loss of $7,000, will be rebuilt. New machinery will be required.

The Relation Between Production and Cost Compared*

By H. L. Gantt

It has been common practice to make the product of a factory running at part capacity to bear the whole expense. This is recognized by many as illogical, although no rational theory as to what proportion of expense such product should bear has been advanced.

MANUFACTURERS in general recognize the vital importance of a knowledge of the cost of their product, yet but few of them have a cost system on which they are willing to rely under all conditions.

While it is possible to get quite accurately the amount of material and labor used directly in the production of an article, and several systems have been devised which accomplish this result, there does not yet seem to have been devised any system of distributing that portion of the expense known variously as indirect expense. burden or overhead, in such a manner as to make us have any real confidence that it has been done properly.

Indirect Expense Distribution.

There are in common use several methods of distributing this expense. One is to distribute the total indirect expense, including interest, taxes, insurance, etc., according to the direct labor. Another is to distribute a portion of this expense according to direct labor, and a portion according to machine hours. Other methods distribute a certain amount of this expense on the material used, etc. Most of these methods contemplate the distribution of all of the indirect expense of the manufacturing plant, however much it may be, on the output produced, no matter how small it is.

If the factory is running at its full or normal capacity, this item of indirect expense per unit of product is usually small. If the factory is running at only a fraction of its capacity, say one-half, and turning out only one-half of its normal product, there is but little change in the total amount of this indirect expense, all of which must now be distributed over half as much product as previously, each unit of product thereby being obliged to bear approximately twice as much expense as previously.

When times are good, and there is plenty of business, this method of accounting indicates that our costs are low; but when times become bad and business is slack, it indicates high costs due to the increased proportion of burden each unit has to bear. During good times, when there is a demand for all the product we can make, it is usually sold at a high price and the element of cost is not such an important factor. When business is dull, however, we cannot get such a high price for our product, and the question of how low a price we can afford to sell the product at is of vital importance. Our cost systems, as generally operated at present, show under such conditions that our costs are high, and if business is very bad, they usually show us a cost far greater than the amount we can get for the goods. In other words, our present systems of cost accounting go to pieces when they are most needed. This being the case, many of us have felt for a long time that there was something radically wrong with the present theories on the subject.

As an illustration, I may cite a case which recently came to my attention. A man found that his cost on a certain article was 30 cents. When he found that he could buy it for 26 cents, he gave orders to stop manufacturing and to buy it, saying he did not understand how his competitor could sell at that price. He seemed to realize that there was a flaw somewhere, but he could not locate it. I then asked him what his expense consisted of. His reply was labor 10 cents, material 8 cents, and overhead 12 cents. My next question was:—Are you running your factory at full capacity? and got the reply that he was running it at less than half its capacity, possibly at one-third. The next question was: What would be the overhead on this article if your factory were running full? The reply was that it would be about 5 cents; hence the cost would be only 23 cents. The possibility that his competitor was running his factory full suggested itself at once as an explanation.

The next question that suggested itself was how the 12 cents overhead, which was charged to this article, would be paid if the article was bought. The obvious answer was that it would have to be distributed over the product still being made, and would thereby increase its cost. In such a case it would probably be found that some other article was costing more than it could be bought for; and, if the same policy were pursued, the second article should be bought, which would cause the remaining product to bear a still higher expense rate. If this policy were carried to its logical conclusion, the manufacturer would be buying everything before long, and be obliged to give up manufacturing entirely. The illustration which I have cited is not an isolated case, but is representative of the problems before a large class of manufacturers, who believe that all of the expense, however large, must be carried by the output produced, however small.

This theory of expense distribution is quite widespread, and clearly indicates a policy, which in dull times would, if followed logically, put many of our manufacturers out of business. In 1897 the plant of which I was superintendent was put out of business by just this kind of logic. It never started up again.

Fortunately for the country, our people as a whole will finally discard theories which conflict with common sense; and, when their cost figures indicate an absurd conclusion, most of them will repudiate the figures. A cost system, however, which fails us when we need it most, is of but little value and it is imperative for us to devise a theory of costs that will not fail us.

Systems Devised by Accountants.

Most of the cost systems in use, and the theories on which they are based, have been devised by accountants for the benefit of financiers, whose aim has been to criticize the factory and to make it responsible for all the shortcomings of the business. In this they have succeeded admirably, largely because the methods used are not so devised as to enable the superintendent to present his side of the case.

Our theory of cost keeping is that one of its prime functions is to enable the superintendent to know whether or not he is doing the work he is responsible for as economically as possible, when function is ignored in the majority of the cost systems now in general use. Many accountants, who make an attempt to show it, are so long in getting their figures in shape that they are practically worthless for the purpose intended, the possibility of using them having passed. In order to get a correct view of the subject we must look at the matter from a different and broader standpoint. The following illustration seems to put the subject in its true light:—

Let us suppose that a manufacturer owns three identical plants, of an economical operating size, manufacturing the same article, — one located in Albany, one in Buffalo, and one in Chicago,—and that they are all running at their normal capacity and managed equally well. The amount of indirect expense per unit of

*From a paper read at the Spring Meeting, American Society of Mechanical Engineers.

product would be substantially the same in each of these factories, as would be the total cost. Now suppose that business suddenly falls off to one-third of its previous amount and that the manufacturer shuts down the plants in Albany and Buffalo, and continues to run the one in Chicago exactly as it has been run before. The product from the Chicago plant would have the same cost that it previously had, but the expense of carrying two idle factories might be so great as to take all the profits out of the business; in other words, the profit made from the Chicago plant might be offset entirely by the loss made by the Albany and Buffalo plants. If these plants, instead of being in different cities, were located in the same city, a similar condition might also exist in which the expense of the two idle plants would be such a drain on the business that they would offset the profit made in the going plant.

Size of Plant.

Instead of considering these three factories to be in different parts of one city, they might be considered as being within the same yard, which would not change the conditions. Finally, we might consider that the walls between these factories were taken down and that the three factories were turned into one plant, the output of which had been reduced to one-third of its normal volume. Arguing as before it would be proper to charge to this product only one-third of the indirect expense charged when the factory was running full.

If the above argument is correct we may state the following general principle: THE INDIRECT EXPENSE CHARGEABLE TO THE OUTPUT OF A FACTORY BEARS THE SAME RATIO TO THE INDIRECT EXPENSE NECESSARY TO RUN THE FACTORY AT NORMAL CAPACITY, AS THE OUTPUT IN QUESTION BEARS TO THE NORMAL OUTPUT OF THE FACTORY.

This theory of expense distribution, which was forced upon us by the abrupt change in conditions brought on by the war, explains many things which were inexplicable under the older theory, and gives the manufacturer uniform costs as long as the methods of manufacture do not change. Under this method of distributing expense there will be a certain amount of undistributed expense remaining whenever the factory runs below its normal capacity. A careful consideration of this item will show that it is not chargeable to the product made, but is a business expense incurred on account of our maintaining a certain portion of the factory idle, and chargeable to profit and loss. Many manufacturers have made money in a small plant, then built a large plant and lost money for years afterwards, without quite understanding how it happened. This method of figuring gives a clear explanation of that fact and warns us to do everything possible to increase the efficiency of the plant we have, rather than to increase its size.

This theory seems to give a satisfactory answer to all the questions of cost that I have been able to apply it to, and during the past few months I have laid it before a great many capable business men and accountants. Some admitted that this viewpoint would produce a very radical change in their business policy, and are already preparing to carry out the new policy. It explains clearly why some of our large combinations of manufacturing plants have not been as successful as was anticipated, and why the small, but newer plant, is able to compete successfully and make money, while the combinations are only just holding their own.

The idea so prevalent a few years ago, that in the industrial world money is the most powerful factor, and that if we only had enough money, nothing else would matter very much, is beginning to lose its force, for it is becoming clear that the size of a business is not so important as the policy by which it directed. If we base our policy on the idea that the cost of an article can only legitimately include the expense necessarily incurred either directly or indirectly in producing it, we shall find that our costs are much lower than we thought, and that we can do many things which under the old method of figuring appeared suicidal.

Common Acceptation of Cost.

The view of costs so largely held, namely, that the product of a factory, however small, must bear the total expense, however large, is responsible for much of the confusion about costs and hence leads to unsound business policies. If we accept the view that the article produced shall bear only that portion of the indirect expense needed to produce it, our costs will not only become lower, but relatively far more constant, for the most variable factor in the cost of an article under the usual system of accounting has been the "overhead," which has varied almost inversely as the amount of the product. This item becomes substantially constant if the "overhead" is figured on the normal capacity of the plant. Of course a method of accounting does not diminish the expense, but it may show us where the expense properly belongs, and give us a more correct understanding of our business.

In our illustration of the three factories, the cost in the Chicago factory remained constant, but the expense of supporting the Buffalo and Albany factories in idleness was a charge against the business, and properly chargeable to profit and loss. If we had loaded this expense on the product of the Chicago factory, the cost of the product would probably have been so great as to have prevented our selling it, and the total loss would have been greater still.

When the factories are distinctly separate, few people make such a mistake, but where a single factory is three times as large as is needed for the output, the error is frequently made, with results that are just as misleading. As a matter of fact it seems that the attempt to make a product bear the expense of plant not needed for its production is one of the most serious defects in our industrial system to-day, and farther reaching than the differences between employers and employees.

The problem that faces us is then first to find just what plant, or part of a plant, is needed to produce a given output, and to determine the "overhead" expense on operating that plant or portion of a plant. This is primarily the work of the manufacturer, or engineer, and only secondarily that of the accountant, who must, as far as costs are concerned, be the servant of the superintendent. In the past, in almost all cost systems the amount of "overhead" to be charged to the product, when it did not include all the "overhead," was more or less a matter of judgment. According to the theory now presented, it is not a matter of judgment, but can be determined with an accuracy depending upon the knowledge the manufacturer has of the business. Following this line of thought it should be possible for a manufacturer to calculate just what plant and equipment he ought to have, and what the staff of officers and workmen should be to turn out a given profit. If this can be correctly done, the exact cost of a product can be predicted. Such a problem cannot be solved by a cost accountant of the usual type, but is primarily a problem for an engineer, whose knowledge of materials and processes is essential for its solution.

Functions of a Cost System.

Having made an attempt to solve a problem of this type, one of the most important functions we need a cost system to perform, is to keep the superintendent continually advised as to how nearly he is realizing the ideal set, and to point out where the shortcomings are. Many of us are accustomed to this viewpoint when we are treating individual operations singly, but few have as yet made an attempt to consider that this idea might be applied to a plant as a whole, except when the processes of manufacture are simple and the products few in number. When, howver, the pro-

cesses become numerous or complicated, the necessity for such a check becomes more urgent, and the cost keeper who performs this function becomes an integral part of the manufacturing system, and acts for the superintendent, as an inspector, who keeps him advised at all times of the quality of his own work.

This conception of the duties of a cost keeper does not at all interfere with his supplying the financier with the information he needs, but insures that information shall be correct, for the cost keeper is continually making a comparison for the benefit of the superintendent, of what has been done with what should have been done. Costs are valuable only as comparisons, and comparisons are of little value unless we have a standard, which it is the function of the engineer to set.

Lack of reliable cost methods has, in the past, been responsible for much of the uncertainty so prevalent in our industrial policies; but with a definite and reliable cost method, which enables us to differentiate between what is lost in manufacturing and what is lost in business, it will usually become easy to define clearly the proper business policy.

TRADE OPPORTUNITIES IN THE ARGENTINE REPUBLIC.

THE Argentine Republic representative of the Department of Trade and Commerce, Ottawa, deals in a recent report with the following trade opportunities which may be made more or less available:

Tools.

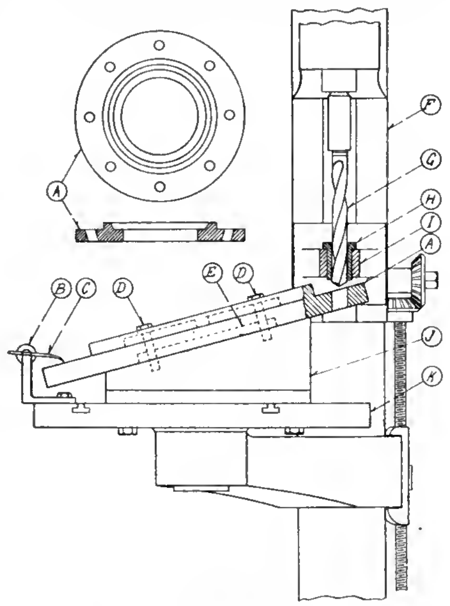
Tools, such as axes, carpenters' tools, taps and dies, spanners, etc., have been imported from the United Kingdom, United States, Germany and France, and in axes and certain classes of carpenters' tools some well-known United States manufacturers are doing a considerable export business. In hand-saws, a very well-known United States make has a strong position, but there is reason to believe that a Canadian-made article of equal price and quality would eventually be able to compete against it. Carpenters' hammers have heretofore been purchased to a very large extent in the northern part of France, and in Alsace. Although this area is included in the war zone, the stocks in hand prevented any shortage being felt, but as they are doubtless becoming depleted, this state of affairs will probably change.

Bolts, Nuts, Screws, Etc.

In Carriage bolts, a Buffalo company practically controls the market, and United States screw companies have a large control of the market in wood screws; in fact, one of these companies has been successful in overcoming the competition of a well-known Birmingham firm, as well as a manufacturer in France. One firm sends the screws wrapped up in small paper packets, tied with string, and another puts them up in neat folding card-board boxes. One large firm stated that three hundred different sizes of screws had to be kept in stock, and for that reason, packing becomes very important. Flat-headed screws are the ones more generally used.

Valves.

English manufacturers have in the past controlled the trade in valves, but owing to the dislocation of business, it will probably be difficult for them to hold it. Canadian manufacturers of valves have an excellent opportunity to extend their sales, as this class of goods is always more or less in demand. A local firm stated that they had been endeavoring to form connections in Canada, but the manufacturer, whom they approached, refused to extend any terms of credit to this market. This seems unfortunate, especially in this instance, as the firm's clients are houses of good standing.



JIG FOR DRILLING ANGULAR HOLES.

Split Wood Pulleys.

Split wood pulleys, although imported into Argentina, are also manufactured in the country.

Metal Goods.

There has been a strong demand for metal lathing, but owing to the present dislocation of the building trade, this has almost entirely ceased, except for those buildings which are being completed. This demand, however, will probably appear again when times become more prosperous. Canadian manufacturers therefore should not wait until prosperity sets in, but should now form their connections so that they may be ready to take advantage of the improvement in business whenever this may occur. The Canadian product seems to be able to compete with that of any other country.

The same cannot be said of metal ceilings and stamped metal work manufactured in the United States, which, owing perhaps to the greater output, seems to be able to underbid Canadian prices.

Metal tiles, which are used in Canada do not meet with acceptance here, as they require wooden sheathing beneath them, without which they would be penetrated by hail. The necessity for the sheathing constantly renders the price prohibitive.

There should be some sale for metal culverts, although at the present time there is not much demand for them.

DRILLING ANGULAR HOLES.

By R. Garth.

THE illustration shows a jig for drilling the holes in the piece A at an angle with the base. The piece J is secured to the drill table K; the upper surface—which is turned to the required angle, having a boss to fit the bore of A, which is secured to the piece J in the desired position.

Secured to the drill press upright F is the piece I, which carries the hardened drill bush H, through which the drill G is fed to the work. The piece I is adjustable in a vertical position and always maintains the drill bush H in a central position relative to the drill spindle. By releasing the clamping bolts D, the work is shifted to the next desired location, which is found by the scriber C.

By using a variety of drill bushes H, the piece I can be used for quite a number of different jobs.

The conditions under which aeroplane guns operate are new to the scientist, and the ordinary trajectory formulæ do not wholly apply, principally because of the altitude from which the gun is fired. Guns fired from the ground attain a long range by means of high muzzle elevation, but the aeroplane gun is fired from a great height and has consequently a much greater range, there being stored in the shot fired from it the potential energy due to the height. Thus, if a 3-in. shot were fired from a height of 10,000 ft., there would be potential energy stored in it of 60,000 foot-pounds and, if fired with the gun barrel horizontal, the range would be considerably over 12,000 yards. The same gun, fired from the surface of the earth would have an extreme range of 2,000 yards only.—Ex.

NEW PROCESS DEVELOPMENTS

Inventive Genius and Research Operate to a Dual End — They Aim to Improve What We Now Possess and Bring to Our Service Commodities Before Unknown

CONCERNING DROP FORGINGS FOR AUTOMOBILES.*

By Arthur Stubbs.

THE number of parts or pieces required has an important bearing on the question as to whether these shall be drop forgings or otherwise. If the number of parts required is very small, say less than 100, it may be better to use a casting or a forging, as the cost of a pattern is less than that of a pair of dies, and reduced first cost may outweigh the other advantages of the drop forging. If, however, a considerable number of similar parts are required, the exact number depending largely on the simplicity or otherwise of the design, and also on the dies, drop forgings should be used, as they will give greater consistency in the metal than a casting, so that machining is easier, while the part can be produced with greater accuracy and more closely to size than either a casting or forging. The machining cost will be less, as there will be less metal to remove, except in the case of such a part as a hub, where a casting could be cored out. A drop forging will also be stronger than a casting of the same weight, or lighter for the same strength.

There is, of course, nothing to choose under this head between drop forgings and hand forgings. It is, perhaps, hardly necessary to point out that the process of cutting from the solid can only be applied to a somewhat limited number of parts of the automobile, and they must be of simple and regular form, but if the cost of the dies is taken as the equivalent of that of the special tools necessary for a particular job, a part may probably be machined from the solid more cheaply than a drop forging can be finished. The forging, however, will be stronger, as the operation of forging makes the metal more homogeneous and improves the structure, while in many pieces the grain of the metal will run in a direction which gives better resistance to the stresses.

Material of Dies.

The dies, which may be taken to correspond to the mould for a casting, are made in a variety of materials, depending upon the class of forging and the number required. Cast iron is now seldom used, except in the case of fairly large and plain parts made in wrought iron or mild steel (soft). Common Bessemer steel blocks are used when the quantity required is small and the article fairly simple and large, so that the material for the forging is not hard to work and the dies need not be hardened. The material most generally used is a high-grade Siemens acid steel, made upon a Swedish base, thus containing some "body," so essential to toughness in dies. A general analysis of such a steel is as follows: Carbon, 0.65 per cent.; manganese, 0.60 per cent.; silicon, 0.045 per cent.; sulphur, .02 per cent.; phosphorus, 0.025 per cent.

Crucible cast steel is used when the article is small and the quantity great, and also when the material for the forging is hard to work, such as a high-carbon or alloy steel. Nickel steels have also been used, generally owing to their greater toughness, but it is only in exceptional cases that the cost of this material is justifiable. It is a good axiom to use the best material possible compatible with the cost, as the risk of breakage due to using a poor quality of steel is great, and the few dollars extra cost per 100 lbs. is unimportant compared with the cost of replacing a broken die.

Life of Dies.

The number of forgings which a pair of dies will make depends upon the quality of the steel used for the blocks, the quality of the steel used for the forgings (that is, whether it is ordinary mild steel, high-carbon steel or an alloy steel), and the design of the article, whether it is simple or one requiring very deep or sharp angular impressions. The life of a die is also largely governed by the amount of metal required to be removed for a single re-cut, though it is very seldom in practice that a pair of dies are really worn out in automobile work, as they can usually outlast the design.

The allowance for fin—that is, the thickness of metal between the top and bottom dies, varies from about 1/8 in. to 1/4 in., but, as will readily be appreciated, this depends upon the weight and design of the forging. In many cases the dies must be guttered, so as to allow the waste metal to flow out more easily. This is particularly necessary where the forging has very deep bosses, as dies are very often broken, through the material choking the die owing to the smallness of the outlet or gutter.

In order that the guttering of dies should be fully understood, it may be well to point out that reference is made to something more than the outlet at the end of the die which allows the material to flow out with the tag (the tag being described as the porter-bar, which is welded on to the material being used for the forging). The face of the bottom die is cut away in corrugations so that instead of the die presenting a perfectly flat surface, the actual finishing impression stands up slightly above the face owing to the other part of the die being corrugated. This is very important in the case of forgings which are very liable to choke a die owing to a very deep boss and so on. It also enables the material to flow out evenly in all directions, and, in consequence, the forgings contract more uniformly during cooling.

Production Tolerance.

A drop forging can be produced to a tolerance of 1-32 in. as an ordinary commercial limit for small work, though it is quite possible by careful forging and supplemental re-striking, and provided that the forging is fairly small, to produce work within a few thousandths of an inch of dead size. The degree of accuracy possible in drop forging is, however, very seldom realized, and for work within very fine limits it is absolutely necessary to have multiple dies, that is, one or more pairs of dies for roughing out, and one or more pairs of dies for the finishing operations. It would very often pay to have forgings re-struck, preferably in a pair of finishing dies, especially when the part can be jigged for machining, as the difference in cost between jigging a piece and setting it up separately is very considerable.

Multiple Dies.

In many cases multiple dies are desirable but prohibitive on account of their cost, their use being limited owing to the small number of pieces of any given pattern usually required. A connecting rod made in alloy steel, especially when the rod is to be within a fine weight-limit and carefully balanced, may be quoted as an instance where multiple dies would be desirable. Multiple dies are also necessary if it is desired to eliminate the stresses set up in forging, due to large and deep bosses being adjacent to very thin and long webs. The necessity for eliminating sharp corners and angles, and avoiding the design of parts which have deep and very thin sections is urged. It is also very desirable that the designer should work with the drop forger in this matter.

*From a paper read before the Institution of Automobile Engineers.

After the dies have been cut and tested for correctness with the lead impression, they are then carefully hardened if they are small, but large dies are not usually hardened owing to the risk of breakage. The necessity for slow and uniform heating of dies for hardening is a very important factor, and quite as much care has to be taken to avoid distortion as in hardening a gear blank. The defects due to rapid heating and sudden quenching are well known, but it may be desirable to point out that this very often results in a broken or badly distorted die, which gives rise to the complaint that the forging is not to shape.

Keeping Dies Cool and Clean.

It is very necessary that, during the process of forging, the face of the die should be kept cold, and this is accomplished by directing a blast of air from a 1-in. to 1½-in. diameter pipe on to the face. It is also necessary to keep the dies clean, which is usually accomplished by using a wire brush. To prevent the work from sticking in the die, oil is used, which is thrown into the top die, as the tup rises, by the use of a swab or stick. After the piece has been finished in the die, the fin has to be removed in a pair of trimming dies, which consist of a bed cut out to the finished shape of the forging, and this forms the bottom die, while a punch, formed to the profile of the forging, forms the top die and presses the forging through the bed, thus leaving the fin around the punch. It is scarcely necessary to point out that the fin is removed by a suitably-geared press.

Steel for Automobiles.

In considering the various classes of steel used in the construction of motor cars, it is curious to notice that in many cases where an automobile manufacturer has found a steel which gives him the minimum of trouble he will specify it for every conceivable part. It is common to find a low-carbon, case-hardening steel actually used for steering levers, or a high-nickel-chrome steel for a connecting rod, while a crank-shaft is made of ordinary 0.30 per cent. carbon steel.

As to who should be actually responsible for the choice of the steel to be used in any particular part of a car, there are three alternatives. The automobile maker may (1)—specify both the maker and the quality of the steel; (2)—tell the steelmaker what he wants and allow him to recommend the quality his experience shows to be the most suitable; or (3)—specify his tests and the purpose for which the part is required, and then ask the drop forger to supply a part to meet that test and hold him responsible.

In the first case the automobile manufacturer assumes responsibility as to the final tests, yet in the event of trouble he blames the drop forger or the steelmaker, or probably both. The steelmaker will claim that the drop forger has spoiled the steel by incorrect treatment, and the drop forger will reply that the steel was unsuitable. If the steelmaker accepts the test specified by the automobile manufacturer and recommends a steel for a particular part, he should be held responsible for the final test, provided the instructions he furnishes have been carried out. So far as bar material is concerned, that is probably quite satisfactory, but, in the case of material to be worked up by the drop forger, it leaves a loophole for the steelmaker to evade responsibility by saying that the drop forger has ruined the steel. This may be true, but the ruin may be caused either by careless treatment in not carrying out the steelmaker's instructions, incorrect treatment due to his ignorance of the properties of the steel, for which the steelmaker is largely responsible, or working a steel which was totally unsuitable for that particular part, and for which the steelmaker is responsible. Abundant evidence is available to prove that the steelmaker is not the best qualified to recommend, in all cases, a steel for any particular part.

If the drop forger accepts the test specified by the automobile manufacturer as being reasonable, he can be held responsible for the finished part, because he has a free hand in the choice of the material he buys and of the maker from whom he buys it; he will confine himself to the use of those steels which his experience tells him are most reliable and with the properties of which he is fully acquainted, and this will tend to a more uniform output.

A PISTON RING FIXTURE.

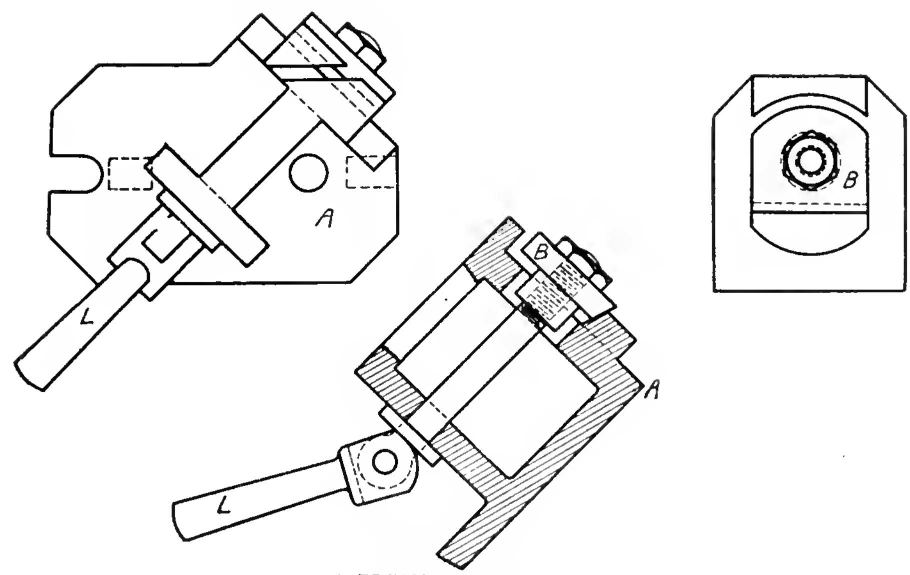
By D. S. Mann.

IN the drawing is shown a fixture for holding piston rings of the smaller sizes while parting same, this being designed particularly for use on the hand-milling machine, although, of course, it is adaptable for the regular machine. The work, however, can be done much more advantageously and cheaply on a hand-fed machine.

The fixture comprises the one main casting A, this being bolted to the machine table, and being provided with lugs for locating in the table slots. The particular rings in this case were split at an angle of 45°, so that the vertical face of the fixture is placed at this angle. The end view and section shows the projecting lug at the top, this being turned to the proper radius for the ring. The latter is held between this lug and the clamping piece B. The clamping piece is cut at a bevel on the bottom, and rests on a corresponding bevel on the main casting; this is operated by means of the cam lever L through the eye bolt.

It will be noticed that the two vertical parts of the main casting are joined by a rib at the top for strength. A heavy spring, not shown in the drawing, is placed around the eye bolt so as to push out the clamping piece B when the cam is released. This cam works on a hardened steel washer. When the cam lever is depressed, the piece B is drawn in, rising on the bevel and clamping the ring which has been placed on the top of same and beneath the projecting lug at the top.

The eye bolt is threaded into the piece B, and is provided with a lock nut, so that adjustments can be quickly made. The cut made by the milling cutter is, of course, carried entirely through the upper part of the frame and lug, and this serves to centre up the cutter.



A PISTON RING FIXTURE.

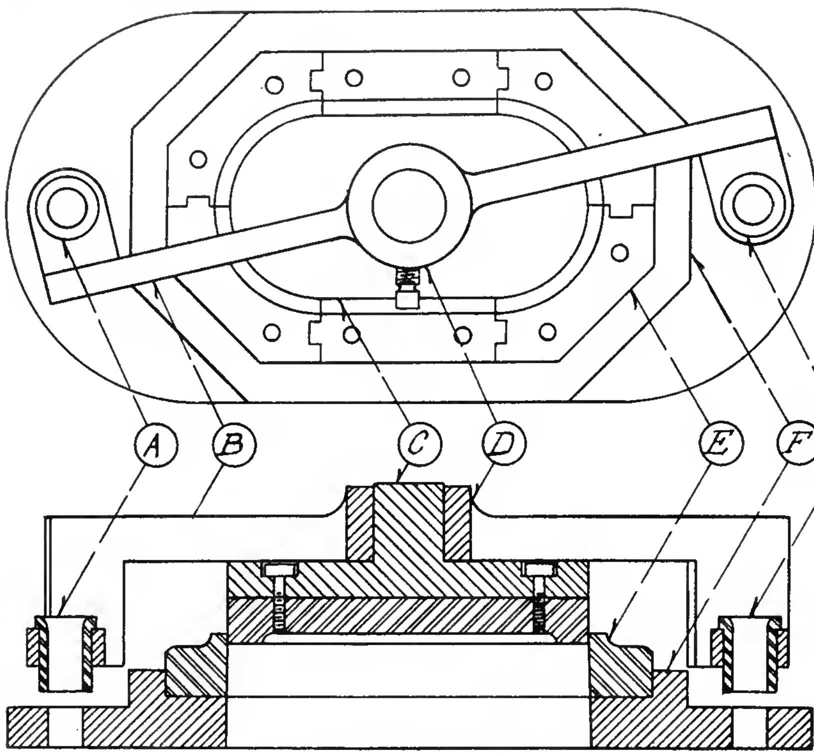
PRODUCTION METHODS AND DEVICES

A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

DRILL JIG FOR DIE BED.

By G. Hamilton.

THE accompanying sketch shows a useful jig for drilling the clamping holes in dies for the punch press, it being sometimes very unhandy to locate these holes in the proper position, especially when the contour of the die is of an irregular shape.



DRILL JIG FOR DIE BED.

The punch C and the die E, being fitted, the jig B is placed upon the shank of the punch holder C, and secured by the set screw shown in the position required. The drilling is performed through the hardened bushes A and G in the usual manner, bringing the holes a certain distance apart, also equidistant from the punch stem and in line with each other.

A FEW MULTIPLE JIGS.

By W. G.

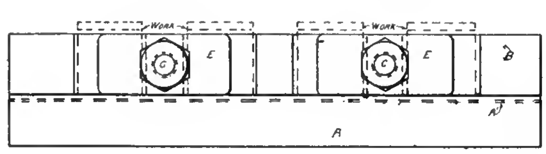
QUITE a number of multiple jigs do not, in actual practice, produce the expected results; this being very often due to one of two things, namely, the locating parts are so enclosed as to render the clearing away of chips a difficult and lengthy operation. Again, the method of holding work is often far too complicated, thus in many cases taking longer to insert and remove the work than to perform the machining operation. It must, of course, be admitted that these conditions cannot always be avoided, but in many cases a little forethought when designing, would mean elimination of the aforementioned troubles.

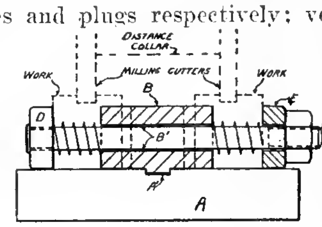
Slitting Jig.

The drawings herewith illustrate a few jigs of the multiple type that have in actual practice proved in every way satisfactory. Fig. 1 shows three views of a slitting jig. The base, part A, consists of a flat rectangular cast iron plate on the upper face of which is formed a tongue groove A^1 for the purpose of aligning the locating or work block B. This is made from a block of mild steel, the longitudinal sides being shaped away to form the eight vee grooves as shown. The said block is further provided with two transverse holes B^1 for receiving the clamp bolts C. These holes should be quite free to the bolts, as this compensates for any unevenness during clamping. Parts D and E are the clamps; these are preferably made from flat mild steel stock, and therefore require but little machining. It will be noticed that the clamps D are made integral with the studs C by screwing and riveting, while the clamps E are a sliding fit. Parts F are the clamp springs, their object being to keep the clamps in the outward position during insertion and removal of work.

Spanner Flats Milling Fixture.

Fig. 2 shows elevation and plan respectively of a fixture used for milling the spanner flats on the end of gland nuts; two settings of the fixture being required to complete the operation. The base G consists of a U-shaped iron casting, provided at its extremities with two feet or projections, G^1 and G^2; the use of which is to secure the base to the machine when in operation. The body H is also made from an iron casting, and consists of a circular disc, on the upper face of which is formed a square block or projection H^1 for carrying the work by means of the holes H^2 as shown. Parts I and J are the mild steel clamping plates and plugs respectively; very little need be said of these, beyond the fact that they (the plugs) should be a free fit in the transverse holes in the





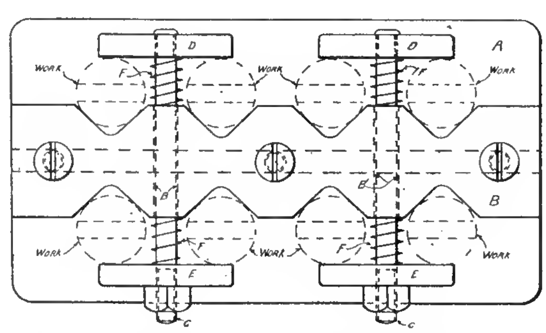


FIG. 1. SLITTING JIG.

block H^1, likewise the clamp stud K. Parts L are the clamp plate springs, and Part M is the fulcrum plug: this is for

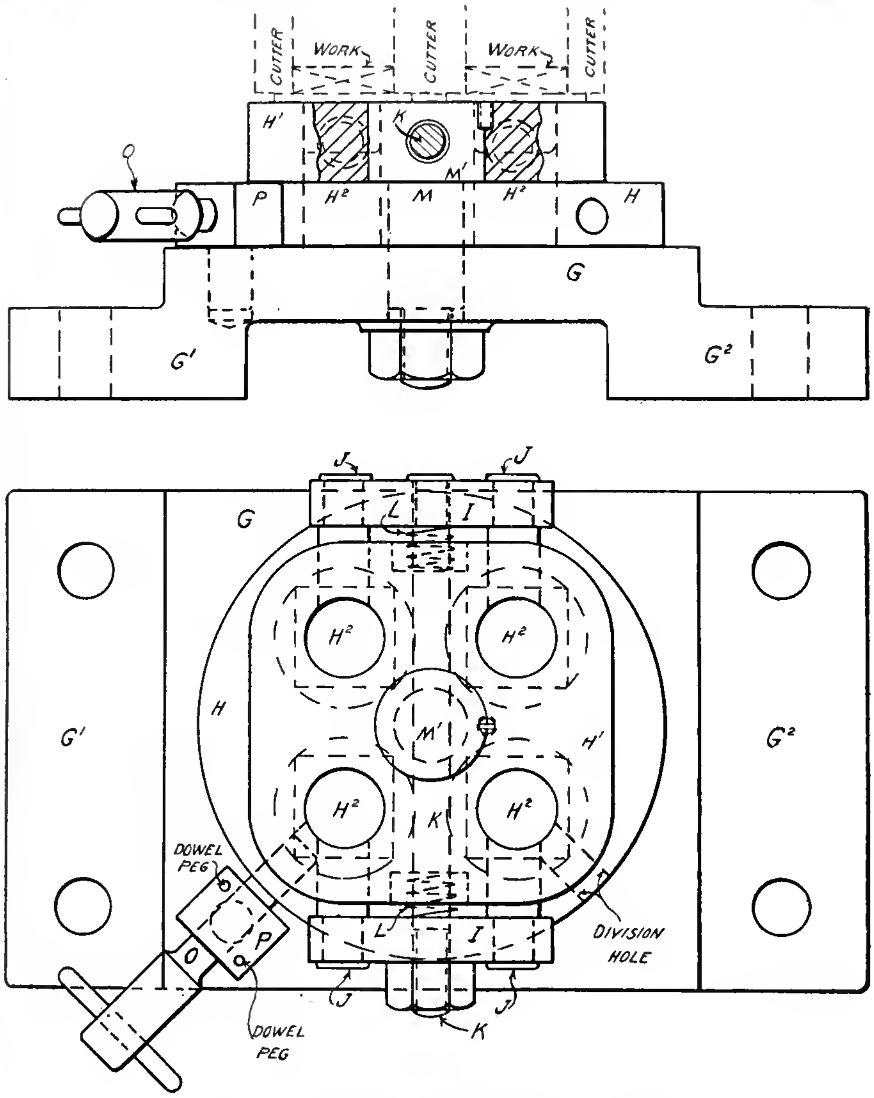


FIG. 2. SPANNER FLATS MILLING FIXTURE.

locking the body in position when in operation. The enlarged part M^1 should be made a tight fit to the central hole in the body, and the reduced part should be a sliding fit (not loose) to the hole in the base G. Indexing is carried out by means of the hardened plug O engaging with the index block P and the two holes at an angle of 90 dgs. apart formed in the periphery of the body H as shown.

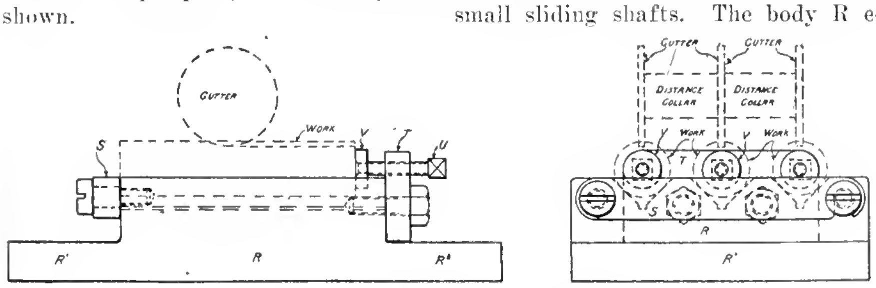


FIG. 3. KEY SLOT MILLING FIXTURE.

The sequence of operations is as follows: The first cut produces parallel flats on the sides of the work; the fixture is next withdrawn, and the index plug removed from the hole in the body H. The locking nut is then slackened off, thus leaving the body free for rotation, until the next hole in its periphery is brought into alignment with the index plug, which is reinserted, and the body locked ready for the next operation (finishing square.)

Key Slot Milling Fixture.

Fig. 3 shows side and end views of a simple fixture for milling key slots in small sliding shafts. The body R consists of a rectangular cast iron block provided at its base with two steps or projections R^1 and R^2, for securing it to the machine table. It is further provided upon its upper face with three vee grooves as shown, for locating the work. Part S is a mild steel thrust plate; it being made to swivel to facilitate cleaning away the chips from the vee grooves. The clamping plate T is also made from mild steel. It is rigidly secured to the body R; its object being to carry the three clamping pins U; these consist of ordinary set screws turned down at the end to receive the mild steel clamping discs V. The object of these latter is to prevent injury to the work when clamping.

It may be worthy of mention that in this particular case it was advantageous to use a separate clamping means for each part, as the overall lengths of the shafts were not particular within 3-32 in., yet it was essential that the length of keyslot from the plain end (uncut) should in each case correspond with the other. This latter was made possible by locating against the face of the thrust plate S by means of the set screws as shown.

THE IMPORTANCE OF CORRECT GATING.

By Arthur Smith.

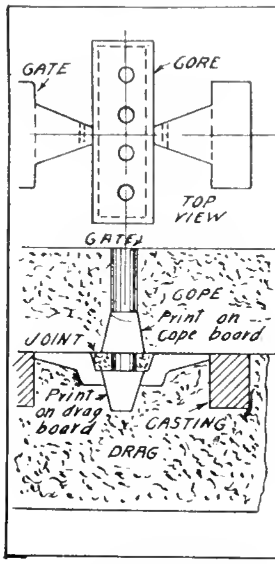
It is perhaps not an exaggeration to state that fully fifty per cent. of the castings proving defective in a foundry are the result, either directly or indirectly, of incorrect gating. A careful and efficient foreman will see that the moulders are provided with proper equipment in the way of flasks; he will insist upon the necessary sands and facings, and will insure that the mould is fully secured and vented, but will leave the location and size of the gates to the judgment of the mechanic.

Correct gating is an art, and it is unfortunate that so few moulders value it at its true worth. We are all aware that if any dirt at all occurs in a casting it will likely be found at or near the gate. Still, many mechanics will place the gate right against or upon a finished face, simply because it offers a convenient place for the metal to enter the casting. Another delusion is that a heavy casting must have large gates, sight apparently being lost of the fact that several small gates will fill the casting equally fast, while the runner box may be kept full at all times and the danger of slag and dirt going down materially reduced.

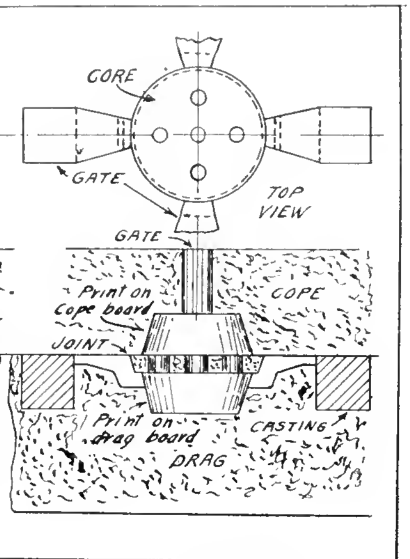
Top or "Pop" Gate.

Many moulders lean toward the top or "pop" gate. This is a round gate, 3/8 in. or 1/2 in. in diameter, placed directly on top of the casting, and in a great many cases it is a first-class arrangement. One of the principal objections to its general use, however, is that the metal falls continuously upon the face

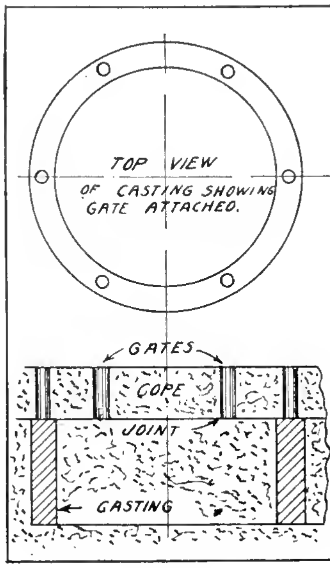
of the mould or core, and is apt to cause cutting or scabbing unless the mould is nailed where the metal strikes. In castings having flanges or pockets where a pool is almost instantly formed, the "pop" gate can not be improved upon.



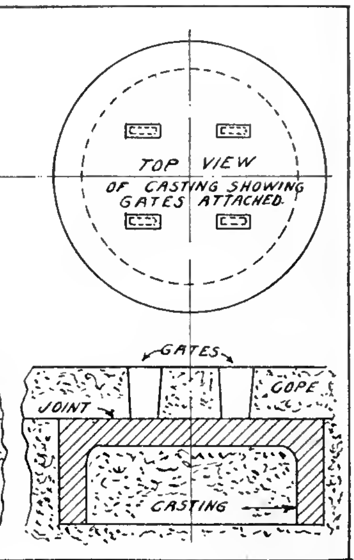
STRAINER GATE RECTANGULAR.



STRAINER GATE ROUND.



POP GATE.



STOVE PLATE GATE.

Flat or "Stove Plate" Gate.

The flat or "stove plate" gate is often used for light work with good results. This gate is usually ¼ in. or ⅜ in. in diameter by from 2 in. to 4 in. wide, and is placed directly on top of the pattern. As the name indicates, it is used extensively for stove-plate work, thin plates, etc. It is remarkable how fast one or two of these gates will take the iron, and the mould fills so rapidly there is little danger of cutting.

The "Strainer" Gate.

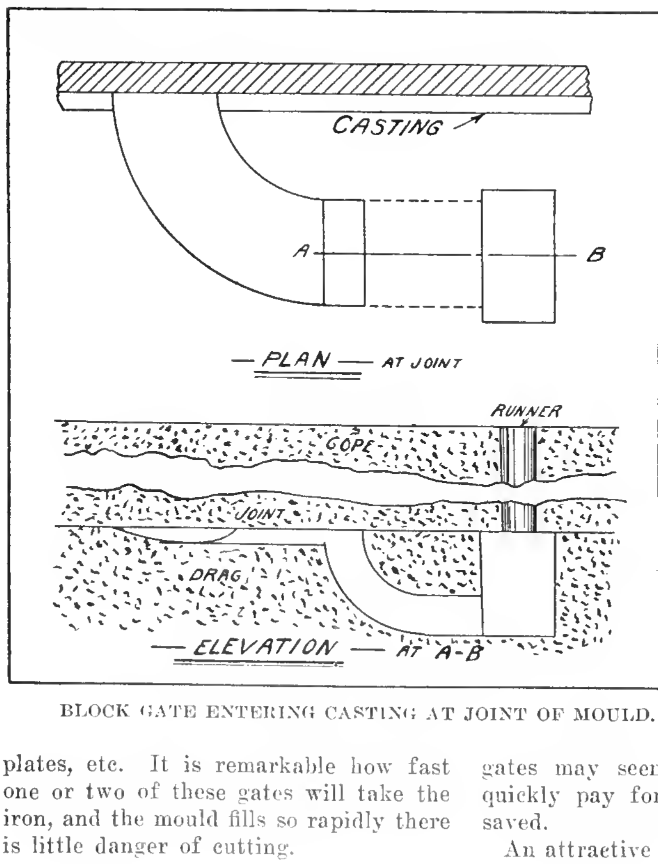
The "strainer" gate for small gated work is one of the most satisfactory that has ever come under the observation of the writer. When using this gate, the metal is strained through a perforated oil sand core, and it is almost impossible for any dirt to enter the mould. In a moulding machine shop, where the work is poured by foreigners, whose chief desire seems to be getting the iron out of the ladle, this gate is invaluable. While the initial expense of equipping machine boards with strainer gates may seem formidable, they will quickly pay for themselves in castings saved.

An attractive method of pouring heavy castings is through the "block" gate. This is a modification of the well known "horn" gate, and its success lies in the fact that the metal is so thoroughly screened there is very little likelihood of any impurities entering the mould. This gate may be made quite heavy, and engine beds weighing several tons are successfully poured with one block gate on each side of the main bearing.

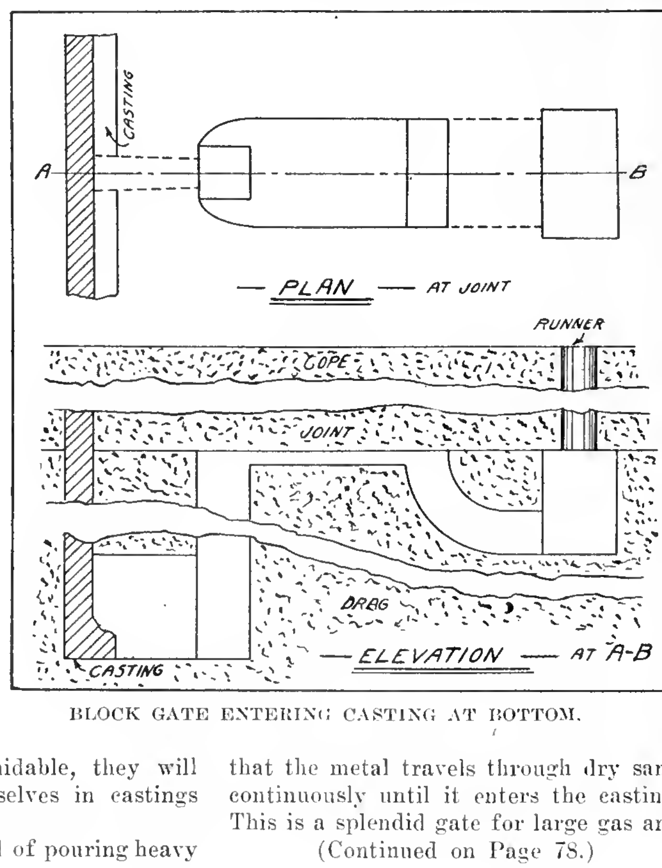
Gating Through the Core.

The old-fashioned method of gating through the core commends itself in many instances, and has the advantage that the metal travels through dry sand continuously until it enters the casting. This is a splendid gate for large gas and

(Continued on Page 78.)



BLOCK GATE ENTERING CASTING AT JOINT OF MOULD.



BLOCK GATE ENTERING CASTING AT BOTTOM.

Arithmetic for the Machinist and Workshop Operative

By J. H. Rodgers

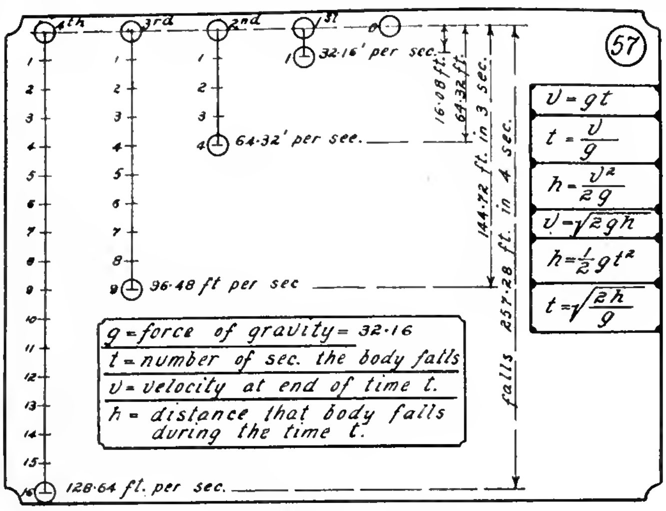
It will be found by those who have followed the previous lessons and profited by them that the various practical applications can now be easily observed, applied and appreciated.

GRAVITATION.

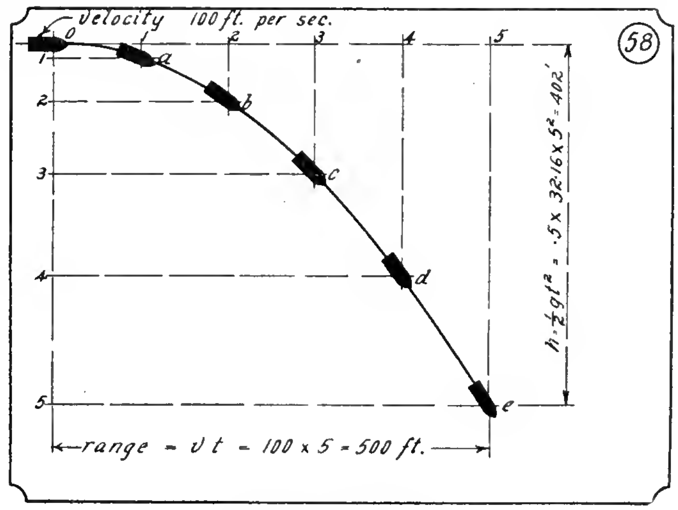
GRAVITATION is the force which is continually acting between two bodies tending to draw them together. The downward pressure of a body (usually termed the weight) is the attraction of the earth toward that body. The attraction between the earth and any body, at or near the surface, is called the force of gravity, and this force will always be the same. By formula:

$$\text{Mass} = \frac{\text{weight of body}}{\text{force of gravity}}, \text{ or } m = \frac{w}{g}.$$

The general laws of weight are that bodies weigh most at the surface of the earth or sea level; that below the surface, the weight decreases as the distance to the center decreases; and that above the surface, the weight decreases weight of a body, the distance above or below the surface must be so great that for all practical purposes the differences need not be considered. If a number of objects irrespective of their size, shape or weight, were allowed to fall within a vacuum, it would be found that each object falls through the same distance in the same time. If, however, the same objects were dropped from a certain



ARITHMETIC CHART 57.



ARITHMETIC CHART 58.

always acts in a straight line between the center of the body and the center of the earth.

The attraction between the earth and a body (and therefore the weight) varies for different locations upon the earth's surface. It is slightly less, above and below, than at the sea level, but if the weight of any body at any place be divided by the force of gravity at that place, the ratio will be the same. This ratio is called the mass of the body, and as the square of the distance increases. By formula, when

d=distance between the centers of the earth and the body.

R=approximate radius of the earth=4,000 miles.

w=weight of body at given distance above or below the surface.

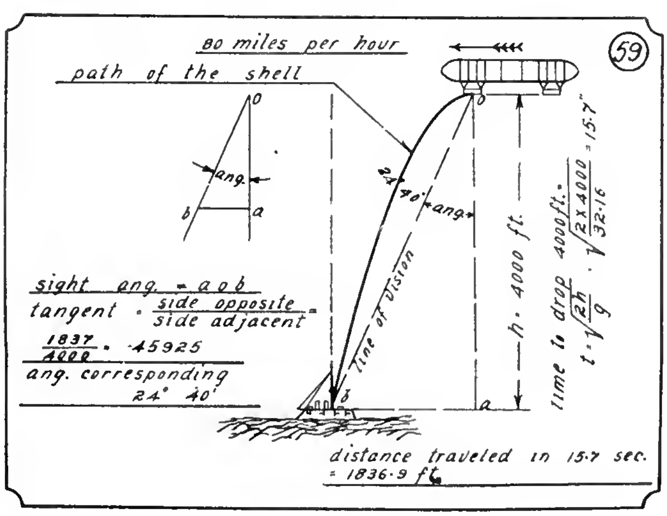
W=weight of body at the surface.

Below the surface:—$wR=dW$.

Above the surface:—$wd^2=WR^2$.

To have any material effect upon the height in free air, the one offering the least resistance to the air would reach the ground first, but if the shape and size of each were the same they would all descend the same distance in approximately the same time.

All bodies being attracted toward the earth with the constant force of gravity will gradually increase their velocity until brought to a state of rest. This increase in velocity is called acceleration. The velocity of a falling body due



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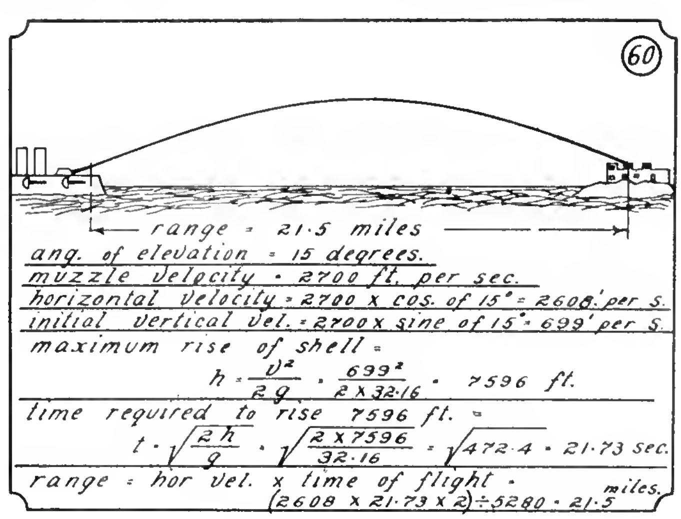


ARITHMETIC CHART 60.

to acceleration is the velocity at the end of one second multiplied by the number of seconds.

The acceleration of a falling body is slightly greater at the poles than at the equator, but for most practical purposes the constant 32.16 is generally used; that is the velocity of a falling body at the end of the first second is 32.16 feet per second. At the end of a fall of four seconds, the velocity would be, $32.16 \times 4 = 128.64$ feet per sec. (See Chart 57.)

It has been found by experiment that a freely falling body will fall 16.08 feet during the first second, and for a greater fall the distance will equal 16.08 multiplied by the square of the time in seconds, or

$h = \frac{1}{2} gt^2$ when

h=height of fall.

g=force of gravity=32.16.

t=time of fall in seconds.

If the machine of an aviator turn turtle at a height of 500 feet and fall

$$h = \frac{1}{2} gt^2 = \frac{1}{2} \times 32.16 \times 5^2 = 402 \text{ ft.}$$

The range will equal the velocity multiplied by the time of flight or

$r = vt = 100 \times 5 = 500$ ft. (See Chart 58.)

If a dirigible airship is travelling at a rate of 80 miles per hour, and at a height of 4,000 feet: what distance in advance must the explosive be allowed to fall to hit its objective?

To find the horizontal velocity of projectile at time of discharge, resolve the speed of airship into ft. per second.

$$\frac{80 \times 5280}{60 \times 60} = \frac{352}{3} = 117\ 1\text{-}3 \text{ ft per sec.}$$

Time required to drop 4,000 ft. =

$$t = \sqrt{\frac{2h}{g}} = \sqrt{\frac{2 \times 4{,}000}{32.16}} = 15.7 \text{ sec.}$$

Distance travelled in 15.7 sec. =

$117 \times 15.7 = 1836.9$ feet.

= 698.8 ft. per sec.

The greatest height to which the shell will rise =

$$h = \frac{v^2}{2g} = \frac{699^2}{2 \times 32.16} = 7596 \text{ feet.}$$

Time required to rise 7,596 ft.——

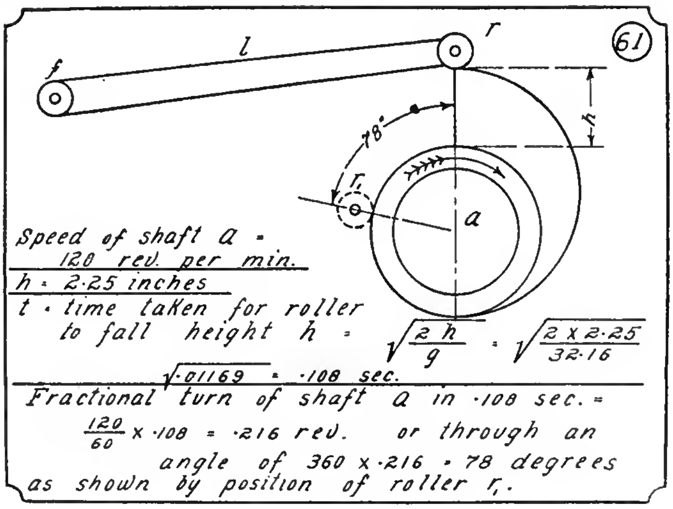
$$t = \sqrt{\frac{2h}{g}} = \sqrt{\frac{2 \times 7596}{32.16}} = \sqrt{472.4} = 21.73 \text{ sec.}$$

Then range = horizontal velocity multiplied by the time of flight =

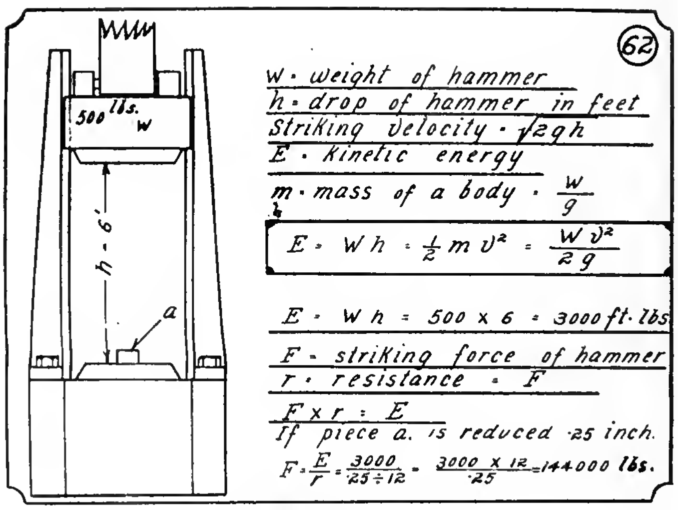
$2608 \times 21.73 \times 2 = 21.5$ miles.

In the sketch of the cam, roller and arm in Chart 61, the shaft A travels at a speed of 120 rev. per min., in the direction of the arrow; at what point on the cam will the roller strike, friction being neglected? Time taken for roller to fall 2.25 inches or .1875 feet =

$$t = \sqrt{\frac{2h}{g}} = \sqrt{\frac{2 \times .1875}{32.16}} = 108 \text{ sec.}$$



ARITHMETIC CHART 61.



ARITHMETIC CHART 62.

freely toward the ground, at what velocity will it strike the earth, allowing a reduction of 15 per cent. in acceleration due to the resistance of the air? By formula

$$v = \sqrt{(2gh)} = \sqrt{(2 \times 32.16 \times 500)} = 179.3 \text{ ft.}$$

Then $179.3 \times .85 = 152$ ft. per sec.

If a baseball be thrown vertically upwards, and five seconds elapse before it returns to the ground, to what height did it go, and what was the initial velocity? As the total time elapsed was 5 seconds, the time of fall was $5 \div 2 = 2.5$ sec. By formula

$h = \frac{1}{2} gt^2 = \frac{1}{2} \times 32.16 \times 2.5^2 = 100.5$ ft., and

$v = gt = 32.16 \times 2.5 = 80.4$ ft. per sec.

If a projectile be discharged in a horizontal direction at a velocity of 100 ft. per second, what must be the height of gun if shell strikes the ground at the end of the fifth second, and what is the range? As gravity acts constantly irrespective of the velocity, the height=

As this distance could not be readily reckoned at such a height, the angle corresponding must be found. As will be seen from Chart 59, the line of vision ob forms the hypotenuse of the right triangle oab of which the sides are the elevation and distance travelled respectively. The sight angle = a o b, then

$$\text{tangent} = \frac{\text{side opposite}}{\text{side ajacent}} = \frac{1837}{4000} = .45925,$$

and angle corresponding = 24° 40 minutes.

If a naval gun (Chart 60) be discharged with a muzzle velocity of 2,700 ft. per sec. at an elevation of 15 degs.; what will be the approximate range, the resistance of the air being neglected? Resolving the angular velocity into the horizontal and vertical components we have horizontal velocity =

$2700 \times \cos.$ of $15° = 2700 \times .96593 = 2608$ ft. per sec.

Initial vertical velocity =

$2700 \times \text{sine of } 15° = 2700 \times .25882$

At 120 rev. per min., the shaft will revolve in .108 sec.

$$\frac{120}{60} \times .108 = .216 \text{ of a revolution,}$$

or through an angle of

$360 \times .216 = 78°$

If the head of a drop hammer, weighing 500 lbs. fall a distance of 6 feet, reducing a piece of metal ¼ of an inch in thickness; what is the kinetic energy and the striking force of the blow? The kinetic energy of a falling body is the weight of the body multiplied by the distance in feet through which it falls, or

$E = Wh = 500 \times 6 = 3000$ ft. lbs.

The striking force of a falling body equals the resistance, and the product of the two equals the kinetic energy, then, as the resistance or compression of the metal = .25 inch, we have

$$F = \frac{E}{r} = \frac{3000}{.25 \div 12} = \frac{3000 \times 12}{.25} = 144{,}000 \text{ lbs.}$$

EDITORIAL CORRESPONDENCE

Embracing the Further Discussion of Previously Published Articles, Inquiries for General Information, Observations and Suggestions. Your Co-operation is Invited

FACULTY OF SPOTTING PLANT IMPROVEMENTS.

By James E. Cooley.

We are spoken of as "creatures of habits." In repeating certain acts, in time we become sprinkled with a blindness, so that we do not realize when we are doing these things, and why we are doing them; we become unconscious of the real motive behind our efforts. This is plainly what is called "being in a rut." We cannot see and will not see until circumstances or someone points the way out for us.

Opportunity Always Present.

No person, no place, or institution escapes from this peculiar lethargic state, and the machine shop is included in the list. Where so much depends on saving time and reducing costs, it is hardly believable, until we are shown the facts, how many foolish and wasteful acts are done in the course of one's daily labor. A stranger looking in at the shop windows will see many things, and wonder why they are done. The fact of the matter is that while one can see easily enough from without, none apparently can see from within. It is only as we step outside that we can see inside a circle.

Repitition, doing the same things over and over, has the effect of deadening the brain's activity, and lessening the power of being able to think along new lines. If we study rut-making conditions we will become gradually enlightened and see the necessity of periodically changing the regular order of the things we do, for the mere sake of keeping clear of getting in a rut.

Being Alert to Opportunity.

There is no known method of advancing except by watching for opportunities to improve things. The reason why we do not go ahead and do things is because the impressions we receive do not go in deep enough to affect us, to stir us up to act; even having started something, we soon lose sight of the object we strive for. We adopt means for certain ends, then reverse the order so to speak, shift the thing around and preserve and uphold the means regardless of what the ends are. We become sprinkled with a blindness or what is the same thing, we enter into a state of "forgetfulness." The trouble is as before stated, our impressions do not get in deep enough, so that we wont' forget, so that we will remember what we are doing and why we are doing it. If we can get this fact strongly enough imbedded in our minds we seldom will get into a rut, or getting there, will know when is the opportune time to jump out.

Typical Examples.

A few cases are here cited to show what this rut-evil really is. A machine for grinding was bought and installed in a corner of a room by itself. In order to keep the machine clean and free from dust when not in use, a few yards of cloth were bought to cover it entirely. When workmen desired to use the machine they would pull off the cloth, double it up any old way and toss it on the bench, regardless of whether the bench was clean or not. When their job was finished they would throw back the cloth on the machine, without noting which was the top or dirt-covered side of the cloth. In time the cloth became soiled on both sides, and as much dirt was placed on the machine as was kept off. This repetition of removing and replacing the cloth was kept up for years.

If a "notice" had been put up stating what the cloth was for, which side was to be placed over the machine, and that it was to be taken off carefully and folded, the machine-users might have received a deep enough impression of their duties. One would think, however, that common sense was sufficient to indicate the proper thing to do in a matter of this kind without the aid of printed instructions. No, we can never depend on suppositions. While no great amount of profit was lost in this practice, it was a foolish action each time it was repeated.

A certain section of a factory was set apart for making up small shipments. Under a work-bench was placed several kegs of nails, one behind the other. Each time the packer wanted nails he had to reach down and rummage in the several kegs before he could find the size nails required. It would seem that the waste of this time, and constantly running into this inconvenience would have brought some enlightenment to the workman to the end that it would have led him to have the kegs placed on a bench purposely made, and have each size or sample of nail placed on the outside of each keg. This idea failed to materialize, however, as similar ideas fail to come to us. This inconvenience would never be discovered, and this and other wasteful methods of doing things would never be found out, unless a systematic study of each detail connected with machine-shop work was carried out.

A sweeper was given a long handle brush to sweep the floor of a room containing special machinery, so as not to raise too much dust. When he was through with it he stood it up against a post in the room. The sweeper left, other sweepers came after him, and each one who used that brush placed it back in the same identical place against the post. Workmen walking near it knocked the brush down, then picked it up again, and as many times as that long handle brush was used, and, as many times as it was knocked to the floor, it never occured to anyone to plug a hole in the end of the handle, loop a string through it and hang it to a peg.

Criticism Beneficial.

The reason why we act, why we make changes, is because someone suggests the idea to us to do so, otherwise we never make the effort. We need criticisms as well as suggestions, we need a lot of them, but we are dependent on one another for them, we have got to "see" for each other. Throughout each factory there are useless and wasteful practices blindly and thoughtlessly followed. Each detail needs to be carefully looked into. Disorder is found in the way some things are kept, and things are done that should never be done as they are. For example, crowbars and skid-rolls are kept in a corner or behind a door where they tumble down and workmen stumble over them. An upright-bin, sectioned off, should be built, and these materials placed in it. Again, a helper shovels up the cast-iron chips from under machines and pans into an open box, causing clouds of dust to fly upward, which gets into the belts and bearings and settles on everything. The box should be covered over, having an opening sufficient for the shovel to enter and thus keep the dust down.

Systematic Study of Detail.

Several changes such as these are required in many factories. The need only, is to develop the faculty to see them. This is best acquired by systematically studying each detail and improving it.

THE USE OF FLUX IN THE BRASS FOUNDRY.

By R. Micks.

THE intelligent use of flux in melting brass and other alloys has been proven beyond doubt to be a great help to foundrymen in producing sound castings from the different alloys, and, while in some foundries the flux question is overdone, there are still some brass founders who do not seem to see the advantage of using a flux when melting their metals. The experience of experts along these lines has shown very clearly that the right flux for the right metal when it is used at the proper time in the melting will not only produce better castings, but will also save metal.

Copper.

Good sound castings cannot be produced from copper when it is melted alone, and more chemicals have been tried and more different fluxes proposed for this metal than for any other used in making alloys. The difficulties of securing sound copper castings are due to oxygen-nitrogen and oxygen containing gases, and to overcome this trouble, it is necessary to use a flux or deoxidizing agent.

The flux now generally acknowledged as the best for copper is boron sub-oxide. This flux has a high affinity for these gases, but no affinity for copper. Potassium-ferro-cyanide has also been found to give good results as a flux for copper. Many foundrymen prefer, however, to use deoxidizing agents, such as silicon-copper-magnesium, phosphorus, etc.

Brass and Bronze.

For brass and bronze, common salt is almost universally used as a flux, and some founders claim to have got the best results with rock salt. The action of salt on these metals is that it forms a protective coating and prevents oxide of copper from forming. To obtain the best results from salt as a flux, it should be added when the first metal in the crucible begins to melt, a handful to the ordinary crucible being sufficient. The brass founder will find that, although cheap, salt will improve the quality of his castings whether he is using new metal or scrap. The metals should be kept well covered with charcoal during the melting process.

Aluminum.

For years, aluminum was melted without a flux or covering, as charcoal, on account of the lightness of aluminum, was almost sure to become mixed with the metal and cause black spots in the castings. Chloride of zinc has proved to be the most valuable flux for aluminum. The action of this flux when used on aluminum is that the zinc combines with the oxygen, which is taken up from the aluminum oxide, and forms zinc oxide. This is then skimmed off, together with the aluminum chloride, which is also formed in the reaction, when the flux is added. A piece of chloride of zinc the size of a walnut is sufficient for 50 lbs. of melted aluminum, and when dropped on the thick mass of dross, covering the surface of the melted aluminum, it will be quickly cleared. The metal should next be stirred, after which its surface will be found perfectly clear. Good, clean castings will be produced, but care should be taken not to raise the temperature any higher than is necessary, as melted aluminum should be protected from the air as much as possible.

Nickel.

The flux used for nickel, and the one that has given the best results, is a mixture of lime and fluor-spar, composed of 3 parts lime and 1 part fluor-spar. The lime should be slake, and it should be mixed with the fluor-spar and then be allowed to become solid, when it can be broken into small pieces for use. While fluor-spar alone acts all right as a flux for nickel, it attacks the crucible, affecting the clay in the crucible mixture in such a manner as to dissolve it, then as nothing but the graphite remains, the crucible goes to pieces when grasped by the tongs. Although the lime counteracts the action of the fluor-spar on the crucibles to a certain extent, they very seldom last more than five or six heats in melting nickel.

Turnings, Washings, Grindings, Etc.

As a flux for melting turnings, washing and grindings, nothing excels plaster of paris, it being not only a first-class flux for this purpose, but also having the advantage of being very cheap. Its main feature as a flux in melting these materials is that it dissolves all foreign matter that may be present in the form of sand, oxide, or slag. It melts quickly and forms a liquid slag, and has no bad effects on the crucible. About five pounds of Plaster of Paris mixed with a crucible full of turnings, washings, grindings, etc., should give desirable results. The metal should be allowed to melt in the usual manner, and if the slag is not fluid enough at the conclusion of the melt, more plaster of paris should be added. When the metal is ready to pour, do not attempt to skim, as the slag will rise to the top when the metal is poured into the ingot moulds, and when they are cool the slag of the plaster of paris can easily be detached by a few blows from a hammer.

COMING CONVENTIONS.

American Foundrymen's Association, Atlantic City, N.J.—Sept. 27-Oct. 1.

Foundry and Machine Exhibition Co., Atlantic City, N.J.—Sept. 25-Oct. 2.

THE IMPORTANCE OF CORRECT GATING.

(Continued from Page 74.)

air cylinders cast on end, the method being to cut the gate through the centre of the barrel, a vent being rammed in each half of the core.

The Runner Box Feature.

Even when the utmost care is exercised in gating, the effectiveness of the gate is often discounted by the sloping and spilling of the metal in the runner box when beginning to pour. To guard against this, some founders place a dry sand runner box on top of the mould. In this runner are placed one or two strainer cores, which collect all dirt or slag before it can reach the gate. This runner core is simple to make, and an ordinary coremaker can turn out a great number in the course of a day. One is surprised at the amount of dirt gathered by the strainer cores, a portion of which would almost of necessity enter the gate.

Gating at Heaviest Section.

Some moulders make a practice of always gating a casting at its heaviest section. While this may be quite convenient, it is decidedly wrong, for the reason that the gate keeps the metal alive at this point so long that a spongy condition results. Unfortunately this is not detected until long after the casting leaves the foundry, and many weak castings are laid to faulty design where, with the proper arrangement of gates and risers, they would be sufficiently strong for the purpose intended.

Independent Line of Sight.—An advantage the Allies have over the Germans in the matter of field artillery is that the former have adopted the "independent line of sight" for sighting their guns. In this arrangement, the gun is mounted on an intermediate carriage, and on this carriage the sight is fixed. In laying the gun, the operator revolves the intermediate carriage screw until the sight glass is on the target, when the gun will also be on the target except as regards elevation. The gun is then given elevation separately. The layer, therefore, does not have to attend at all to elevation, another man being told off for this duty.

Winnipeg, Man.—The Board of Control have awarded the contract for the supply of a steam boiler to Babcock & Wilcox, Montreal, at $2,500.

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

HEAVY DUTY DRILL PRESS, WITH COMPOUND TABLE.

This heavy duty drill press is a product of the Colburn Machine Tool Co., Franklin, Pa. It has a capacity to the full cutting edge of 2-inch high speed drills in solid steel, and is of very rigid construction. Shafts are of high carbon steel and all bearings are bushed with bronze and provided with a positive and reliable method of oiling. All speed and feed changes are obtained through positive gearing by means of handles and levers conveniently located within easy reach of the operator.

The drive is through a constant speed belt on to a single pulley. Speed changes are obtained through selective sliding gears controlled by levers within easy reach of the operator. No countershaft is necessary, as a pair of tight and loose pulleys are mounted directly upon the main driving shaft of the machine, parallel to line shaft.

Six changes of speed are obtained, and never more than two pairs of gears are in mesh at any one time. All changes are made by sliding gears, no clutches being used. Splash lubrication is employed and gears and bearings receive a constant flood of oil.

The spindle is of forged high carbon steel. The thrust is taken on "Hess-Bright" ball thrust bearings spherically seated, which provide for any slight deflections or mis-alignment and distribute the load equally over the full circle of balls. Spindle has a traverse of 16 inches and a No. 5 Morse taper socket.

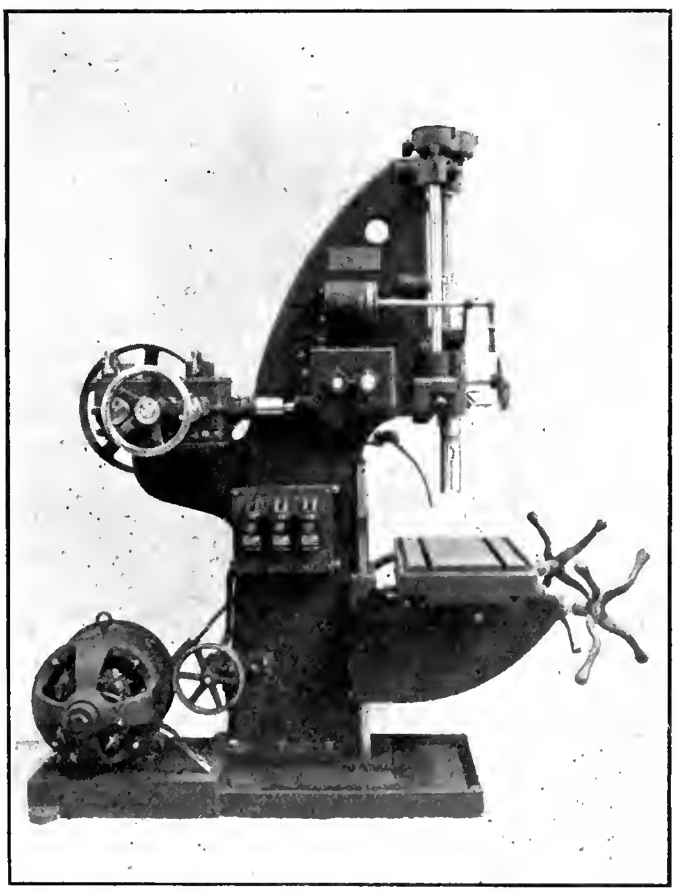
The main spindle driving gear and its pinion have helical teeth. All gears not running in oil bath are covered with dust-proof guards and special grease cups are provided which deliver the lubricant directly on to the teeth. Three spindle feeds are available.

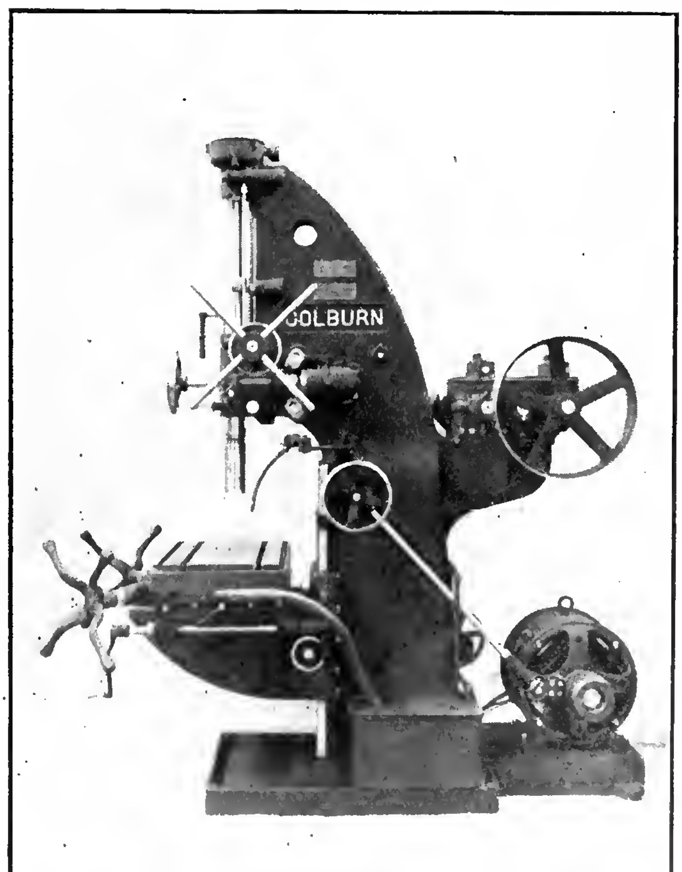
An automatic trip is furnished for tripping the power feed at any desired depth. A final safety trip is also furnished to disengage the feed when spindle has reached its lowest position, thus preventing possible accident.

Quick traverse of the spindle is obtained through four capstan handles, and power feed can be instantly changed to hand feed, or vice versa, by sliding the hand wheel shaft either in or out, thus engaging or disengaging a positive clutch connected to feed train of gearing. A safety device is provided to protect the feed mechanism, which will shear a pin before doing any damage.

The standard table is of the bracket type, gibbed to the column with extra long upright bearing. It has a vertical adjustment of 24 inches by means of rack and pinion and worm and worm wheel. The table can be bored for bushings to support the ends of boring bars up to 3 inches in diameter. The working surface is 18 x 20 inches, and a large oil pan is provided on both sides and in front.

The compound table is not an attachment to the regular table, but consists of a special knee with a table having a rapid movement through spiral worm and rack of 20 inches longitudinally and 8 inches crosswise. Capstan handles are so arranged that the operator standing directly in front of the machine can manipulate the table in both directions without moving from his position. A large oil pocket is cast on each end and a cored opening running entirely through the table drains the lubricant from the





HEAVY DUTY DRILL PRESS WITH COMPOUND TABLE.

left hand to the right hand pocket, and from there it is piped through a flexible tube back to the tank. Grooves along the edges of the table also drain the lubricant from the surface. The working surface of the compound table is 18 inches wide by 30 inches long. An oil pump attached directly to the machine is driven by a belt from pulley on speed box shaft.

The tapping device consists of a pair of friction clutch pulleys mounted on the main driving shaft of the speed box, and, by means of open and cross belts, made to run in opposite directions. To accomplish this the driving shaft is made extra long, and is supported at its outer end by a substantial journal box on the end of a bracket. The clutches are controlled by the lever directly in front of machine. The reversing mechanism of this tapping device being placed directly on the prime mover instead of on the drill spindle, excessive strain on the parts is greatly reduced.

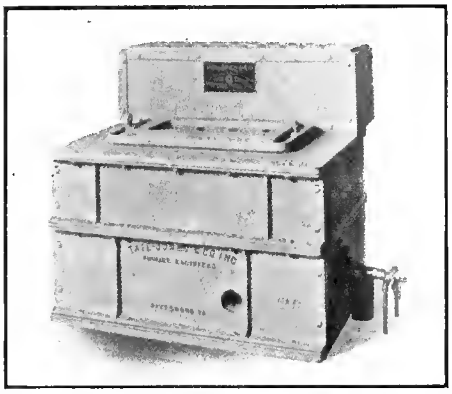
When the machine is to be used for tapping large diameters it is equipped with a tapping hood. This device relieves the strain on the driving key in the spindle gear. The excessive power required to drive a large tap exerts such a pressure on the side of this key that it is almost impossible for the spindle to feed, and this causes the tap to tear the threads and spoil them. With the tapping hood, the friction is reduced to the minimum, since the power is applied through a bar having several times the leverage of the ordinary key in the spindle gear.

With a constant speed motor, the same speed changes are obtained as with regular drive. A "Reliance" motor is mounted on an extension of the base at the rear of the machine, where it is entirely out of the way. A belt drive direct from motor to driving pulley is recommended, and any size or make of constant speed motor from 5 to 10 h.p. can be used, depending upon the work to be performed.

The floor space occupied is 77 in. by 34 in., the height 110 in., and the net weights with plain and compound tables respectively are 3,100 lbs. and 3,700 lbs.

PREHEATED LEAD BATH FURNACE FOR SHELLS.

THE furnace here illustrated has a lead bath, 12 in. wide, 24 in. long, and 12 in. deep. At one end of the bath there is arranged a suitable pocket to accommodate the pyrometer couple. The lead bath proper is covered by a cast iron plate, through which are eight openings for inserting shells. The furnace is specially designed for Russian type shells, these being placed in the already mentioned holes open end up. Plugs in these open ends force the shell down into the lead, until each plug strikes the top plate.



PREHEATED LEAD BATH FURNACE FOR SHELLS.

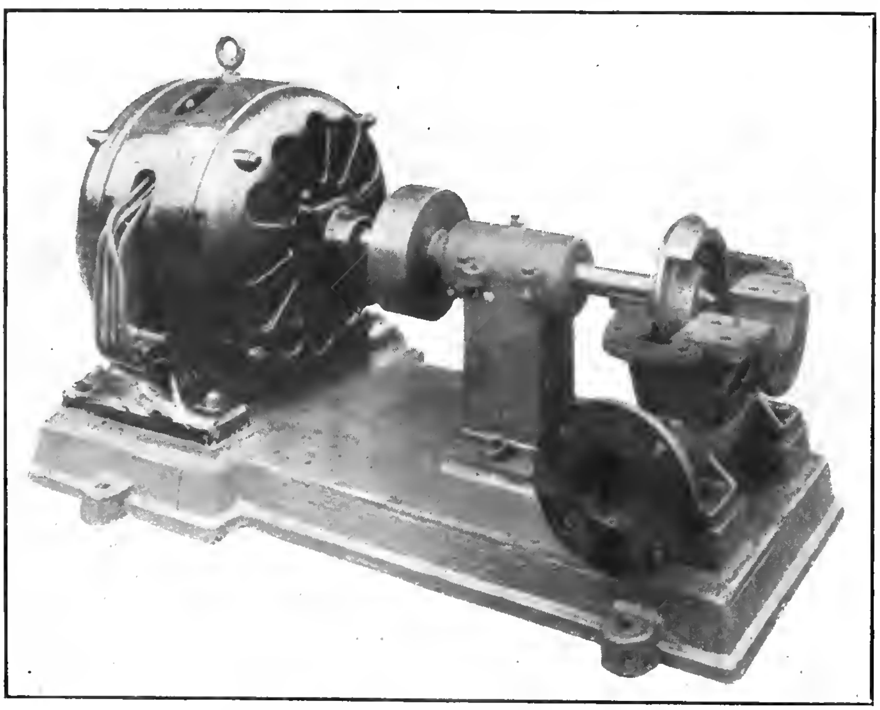
There is sufficient bath in the pot, so that when eight shells are inserted the surface of the lead is up to the bottom of the plate covering the pot, and the shell is immersed to within about 1 in. of its top. As these shells are nosed after the heat-treating operation, this 1 in. receives heat treatment at that time.

In the preheating chamber to the rear of the furnace there is room for twenty shells. The hot gases from the combustion chamber of the furnace pass through this preheating chamber, heating up these shells, and thus taking advantage of considerable heat that would otherwise be wasted.

A distinctive feature of this furnace is the fact that the combustion chamber is entirely separated from the chamber in which the pot rests, the heat passing from one chamber to the other through suitable openings and being distributed evenly over the surface of the pot. The design eliminates excessive heating of the pot at any one point, thereby increasing the life of the pot itself and the furnace proper. Tate-Jones & Co., Pittsburg, Pa., manufacture this product.

CENTRIFUGAL PUMP FOR THICK LIQUORS.

THE cut herewith shows a high efficiency type of centrifugal pump suitable for handling liquors containing large quantities of solids, chemicals, wood pulp, or gun cotton pulp solution. The impeller is designed along high efficiency lines, but has very wide passages in proportion to its capacity, the design being such that, in spite of these wide passages, a high efficiency is obtained without having the pump characteristic such as to produce a heavy overload on the driving motor when operating at pressures below the rated pressure.



CENTRIFUGAL PUMP FOR THICK LIQUORS.

The pump has a horizontally-parted case which facilitates access to the interior for convenience of inspection, cleaning and repairs. The pedestal bearing shown is equipped with two ball bearings operating in a housing packed with a non-fluid oil or light ball-bearing grease. These are so arranged as to carry not only the radial load, but any thrust that may come on the pump in either direction. The impeller, however, is provided with a balancing ring so as to secure approximate hydraulic balance. On account of the large passages through the impeller, the pump is also very suitable for pumping sewage, as solids which would ordinarily choke up a small capacity impeller pass freely through the pump.

The particular pump shown is driven by a single phase motor, and, for the purpose of keeping down the starting current, a special centrifugal clutch coupling is provided, which allows the motor to come up to speed before the load comes on the motor. Either this type of coupling or the standard type of flexible coupling with steel pins and rubber bushings is furnished. This type pump is particularly suited for handling nitrated cotton liquors in connection with the manufacture of gun cotton.

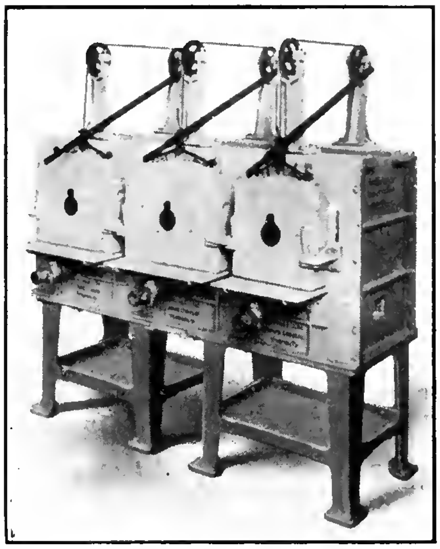
The pump is manufactured by the D'Olier Centrifugal Pump and Machine Co., Philadelphia.

VERTICAL TYPE SUCTION OILER.

TO meet the demand for an oiler embodying the same principle as their universal type (a description of which appeared in these columns some time ago), the Hanna Engineering Works, Chicago, have developed the vertical type shown in the accompanying illustration. The operation of these oilers is entirely automatic, because suction action takes place immediately the air moves and ceases the instant the air is shut off. The necessary amount of lubricant at the proper place and time is, therefore, realized. A chamber containing an absorbent is kept saturated from another large oil storage chamber surrounding it, and air passing through the lubricator becomes sufficiently charged with oil to properly lubricate all surfaces with which it subsequently comes in contact.

VERTICAL TYPE SUCTION OILER.

The universal type oiler can be attached to air line in any position, operating equally well in any plane or angle, and can be filled in no matter what position. The vertical type, on the other hand, can be used only in the position shown. These oilers are made with $\frac{3}{4}$-inch, 1-inch and $1\frac{1}{2}$-inch pipe connections.



THREE-CHAMBER DIE-HARDENING FURNACE.

THREE-CHAMBER DIE-HARDENING FURNACE.

THE description and illustration refer to a three-chamber die-hardening furnace manufactured by Tate-Jones & Co., Pittsburg, Pa. It consists of three distinct separate chambers, two of which are 18 in. wide, 18 in. deep, and 10 in. high. The third chamber is 12 in. wide, 18 in. deep, and 10 in. high. Each has a separate combustion chamber located underneath and separated by a fire brick slab, the heat passing from the combustion chamber through long narrow slots at the sides of this slab into the heating chamber, giving a furnace of semi-muffle construction. Each chamber is fired independently by natural gas or fuel oil burner. Compactness is a feature of the arrangement, and for die work, where long soaking preheating heats are desired before bringing up to the final hardening temperature, special usefulness is claimed.

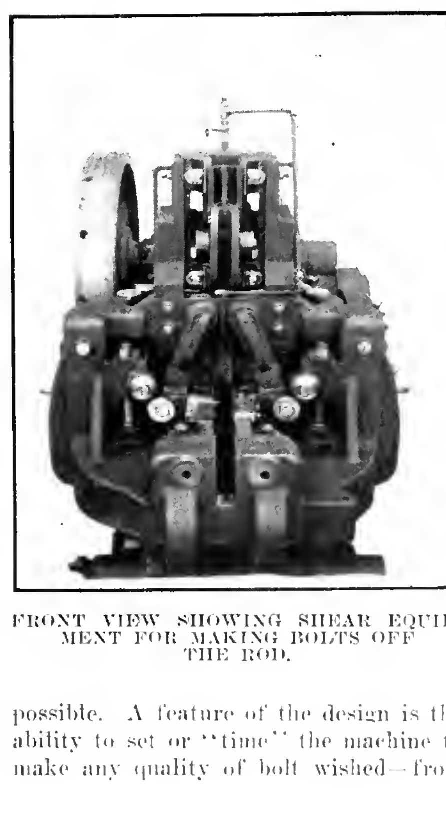
With this furnace, two chambers can be used for preheating and one chamber for hardening, or the three chambers can be used independently for entirely different work. A lever arm is fastened to the rear sheave bracket, and is attached with a suitable sliding arrangement to the lifting links on the door, so that the door can be readily raised and lowered by the movement of this lever. The counterweights for each door drop in the rear of the furnace.

NEW HAMMER BOLT HEADING MACHINE.

IN line with their adopted policy of developing bolt and nut machinery, in which hard manual labor is reduced to a minimum, the National Machinery Co., Tiffin, Ohio, have perfected, and are offering a new type of "hammer" bolt heading machine, termed the "National Continuous Motion Semi-Automatic Hammer Header." This machine is for making square, hexagon and tee head bolts from heated stock, and the following illustrations show some of the features embodied in the design.

About 60 per cent. of the square, hexagon and tee head bolts manufactured are the product of the "hammer" type of bolt header: and the aim of this new design machine is to effect the gripping, starting and stopping movements automatically, so as to free the operator of this labor and enable him to devote his entire attention and energy to feeding the machine. The design has not stopped here, however, for not only are these movements accomplished mechanically and automatically, but the main shaft, heading slide and hammer slides of the machine run continuously like a rivet header—making operation continuous, so that the machine, in a sense, "sets the pace" for the attendant.

A big advantage is gained, too, in having the main shaft, heading slide and hammer slides run continuously, doing away thereby with a starting and stopping clutch on the main shaft, and thus minimizing the attendant troubles of wear and clutch repair. Elimination of this clutch also makes higher speeds



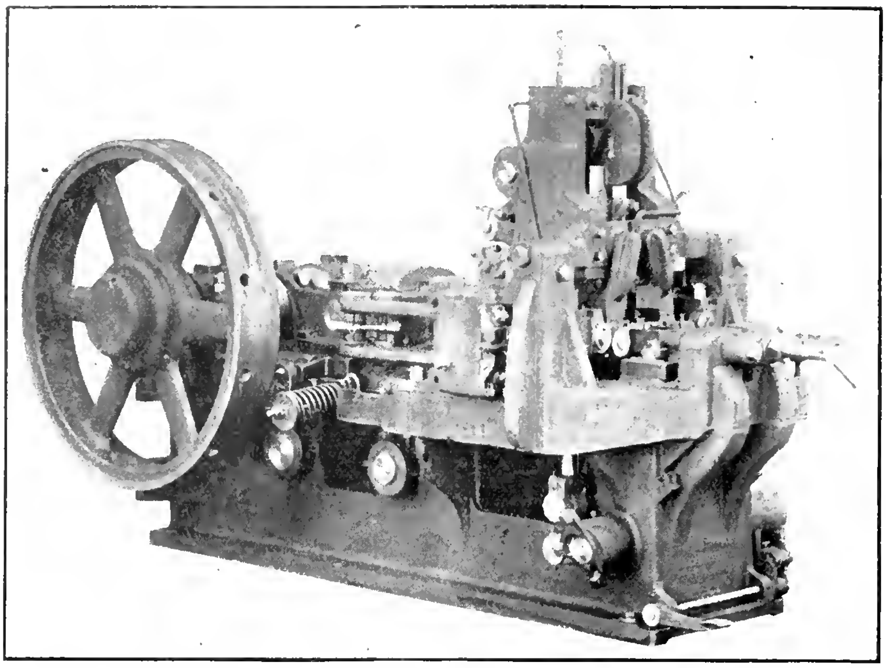
FRONT VIEW SHOWING SHEAR EQUIPMENT FOR MAKING BOLTS OFF THE ROD.

possible. A feature of the design is the ability to set or "time" the machine to make any quality of bolt wished—from

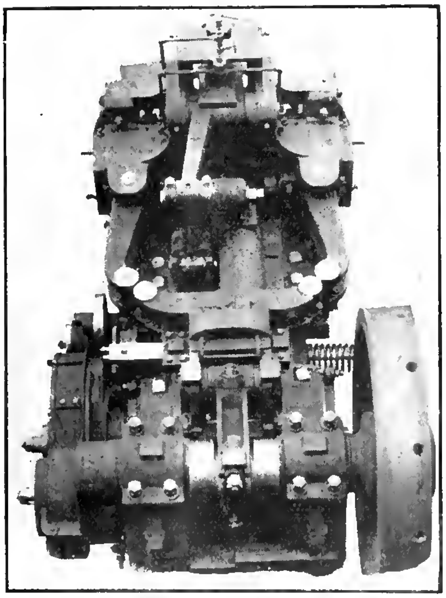
three to eight blows in one cycle or operation; and, with the machine thus set to deliver a predetermined number of blows, the quality of output and finish is necessarily uniform. The length of time, also, that the grips are open for feeding can be regulated to suit the needs or ability of the operator, according to the length or type of bolt being made. These changes are effected through a simple gear and cam construction.

The bed of the machine is of box type, of large proportions and heavily ribbed, inducing stiffness and rigidity as well as strength. The various working parts and details are designed correspondingly. This new hammer header of 1 in. size weighs in round numbers 13,000 pounds, and runs at 140 r.p.m. on its maximum work.

The rigid construction, combined with the mechanically operated grip, makes it practical to introduce a cut-off attach-



THE "NATIONAL" CONTINUOUS-MOTION SEMI-AUTOMATIC HAMMER BOLT HEADER.



REAR VIEW, SHOWING GENEROUS PROPORTIONS OF WORKING PARTS.

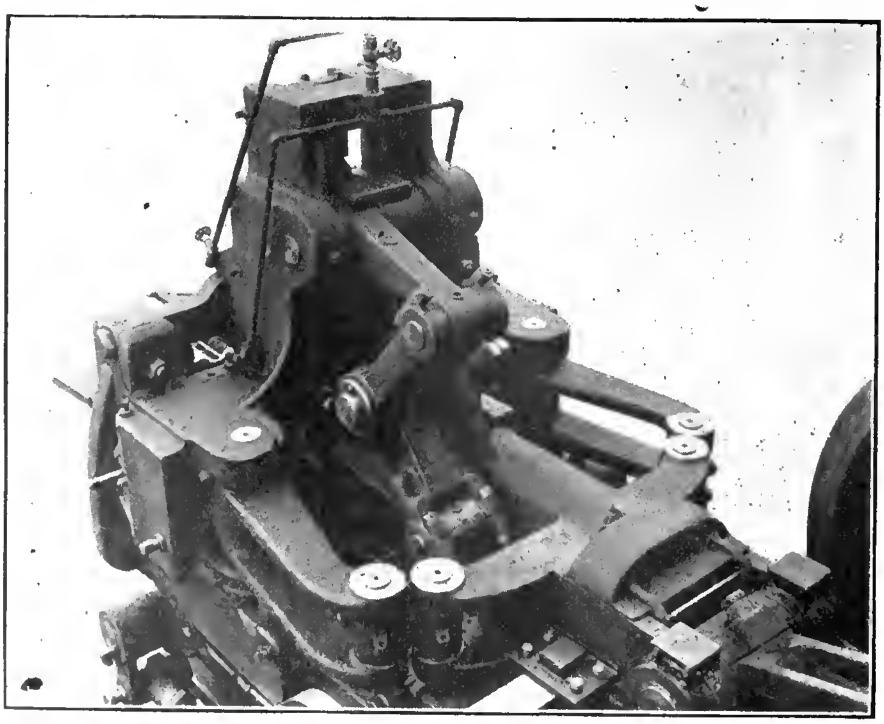
ment in the gripping dies, so that short bolts can be made directly off the rod. Short bolts ordinarily are hard to tong and to grip, and require cut-out dies that are expensive to make and maintain. With this shear or cut-off in the grip dies, however, short bolts are made with ease and facility, and four to six bolts can be made in one heat, depending somewhat, of course, upon the diameter and length of bolt made.

Another departure in this design is the lever construction for carrying the lower hammer. In previous designs the lower hammer was carried in a slide, similar to the side and top hammers, and the scale dropping off the bolt as it was being forged got on to this slide, and this, with the action of the water, caused much trouble because of the excessive wear. This wear caused disalignment of the lower hammer, and demanded constant attention. The lever construction eliminates this wear. The side and top hammer slides in this design are operated by bronze bushed links in place of cams and rolls.

The flywheel is of the "National" friction-slip construction, which fills the role of an automatic safety device in case cold stock or an excess of metal is gripped in the dies and obstructs the travel of the heading tool. An automatic relief is also provided on the gripping mechanism to protect the machine against damage, should the operator accidentally get stock or some foreign object in the grips, other than in the holding grooves, which would prevent the dies from closing, and the machine from completing its cycle.

The slides have been made extra long, and the shaft bearings are of large diameter and bronze bushed, the main shaft bearings being self-oiling. Practically all the bearings have a large oil pocket or cup oiler that is easily accessible; and these pockets, as well as all the oil holes, are provided with sliding or hinged covers to exclude entrance of any possible scale, dust or foreign substance that could induce friction.

This new hammer header is built in $\frac{3}{4}$ in., 1 in., and $1\frac{1}{2}$ in. capacities, for either belt or motor drive.



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SHELLS AND GENERAL SUPPLIES FOR BRITAIN.

IF we might judge by the activities of our engineering and metal-working plant managements relative to the further development of the manufacture of shrapnel and high explosive shells in their every and complete feature, there is abundant evidence that if someone has not blundered, at least dissatisfaction over the paucity and scope of the orders placed exists. It has long since been proved that we can produce shells of first quality and in quantity ad lib, but, being now informed that our efforts lack all merit because only "empty" shells have been made, we naturally get up in arms to defend ourselves and at the same time give indication of both claiming and demanding the opportunity to produce shells with "fixed ammunition" and of earning the accruing merit by our handiwork.

Little compliment has been paid our engineering establishments during all these months of war in that no notice seems to have been taken in official circles of how they grasped and made a huge success of this shell forging and machining business. What was accomplished in this respect many months ago is as yet being only partly realized—much less appreciated officially, and little wonder is it that being fully aware of the call and necessity for "Shells, and Shells, Then More Shells," our leading metal-working plant managements have banded themselves together to "press their suit" without the official aid which was their right to expect, but their misfortune to lean too implicitly upon.

The concentration of effort indicated gives but concrete expression to a gradually developed necessity relative to shell manufacture in our Dominion. The steps already taken to establish and equip plants for the supply of "fixed ammunition" may be taken as a result of the initiative of our plant managements and their staffs. Arrangements are, we understand, now proceeding smoothly and satisfactorily with respect to the provision of fixed ammunition for the various sizes and types of shells being manufactured in Canada, and within the next two months it is expected that the various plants devoted to this feature will be in a position to cope with the output of what are known as "empty shells."

Some half dozen concerns are either equipping or are getting close to production stage relative to the manufacture of brass cartridge cases, and in the matter of the explosive charges, time fuses and detonators, the necessary arrangements have also been made. Much of course is expected from the coming interviews between Mr. Thomas—the accredited representative of Britain's Minister of Munitions, and our Shell Committee, and not the least important movement in the direction of fuller shell making opportunity is that which seeks to have our manufacturers' committee form a unit at the various conference sessions.

Further to the purchase of supplies for the British forces at home and on the European continent, it may be stated that a department for the purpose is now organized and operative in room 114, the Windsor Street Station Block, Montreal. Edward FitzGerald, assistant general purchasing agent of the C.P.R., has been deputed by Sir Thomas Shaughnessy to take charge of this special work. The supplies requirements will, of course, be both varied and numerous, and will in many instances reach to considerable proportions. Manufacturers of such commodities as are being used both on service and for consumption are invited to furnish particulars of their products, which should include prices, degrees of quality, quantities available, procurable and produceable on short notice. Shells, remounts and fodder do not come within the scope of the departmental activities.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey Forge, Pittsburgh	$13 20	$13 45
Lake Superior, charcoal, Chicago	.....	15 75
Ferro Nickel pig iron (Soo)	.....	25 00

	Montreal.	Toronto.
Middlesboro, No. 3	21 00	.....
Carron, special	22 00	.....
Carron, soft	22 00	.....
Cleveland, No. 3	21 00	.....
Clarence, No. 3	21 00	.....
Glengarnock	25 00	.....
Summerlee, No. 1	25 00	.....
Summerlee, No. 3	25 00	.....
Michigan charcoal iron	25 00	.....
Victoria, No. 1	21 00	19 00
Victoria, No. 2X	21 00	19 00
Victoria, No. 2 Plain	21 00	19 00
Hamilton, No. 1	20 00	19 00
Hamilton, No. 2	20 00	19 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	2.20
Steel bars, f.o.b., Toronto	2.20
Common bar iron, f.o.b., Montreal	2.20
Steel bars, f.o.b., Montreal	2.20
Bessemer rails, heavy, at mill	1,25
Steel bars, Pittsburgh	1.25
Twisted reinforcing bars	2.15
Tank plates, Pittsburgh	1.25
Beams and angles, Pittsburgh	1.25
Steel hoops, Pittsburgh	1.30
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.10
Small shapes	2.35
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, 1/4 to 1/2 in., 100 lb.	$2 35	$2 25
Heads, per 100 lb.	2 55	2 45
Tank plates, 3-16 in.	2 60	2 45

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$12 50	$12 50
Copper, crucible	14 50	14 50
Copper, unch-bled, heavy	14 00	14 00
Copper, wire, unch-bled	14 00	14 00
No. 1 machine, compos'n	11 50	12 50
No. 1 compos'n turnings	10 50	9 25
No. 1 wrought iron	6 00	6 00
Heavy melting steel	5 75	6 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings	12 00	12 00
No. 1 brass turnings	10 00	10 00
Heavy lead	4 50	5 00
Tea lead	$ 3 50	$ 3 75
Scrap zinc	12 00	14 00

W. I. PIPE DISCOUNTS.

Following are Toronto jobbers' discounts on pipe in effect June 25, 1915:

	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
Standard				
1/4, 3/8 in.	63	32½	....	....
1/2 in	68	41½	....	....
3/4 to 1½ in.	73	46½	....	....
2 in.	73	46½	69	42½
2½ to 4 in.	73	46½	72	45½
4½, 5, 6 in.	....	....	70	43½
7, 8, 10 in.	....	....	67	40½
X Strong P. E.				
1/4, 3/8 in.	56	32½	....	....
1/2 in.	63	39½	....	....
3/4 to 1½ in.	67	43½	....	....
2, 2½, 3 in.	68	44½	....	....
2 in.	....	....	63	39½
2½ to 4 in.	....	....	63	42½
4½, 5, 6 in.	....	....	66	42½
7, 8 in.	....	....	59	35½
XX Strong P. E.				
1/2 to 2 in.	44	20½	....	....
2½ to 6 in.	....	....	43	19½
7 to 8 in.	....	....	40	16½
Genuine Wrot Iron.				
3/4 in.	57	26½	....	....
1/2 in.	62	35½	....	....
3/4 to 1½ in.	67	40½	....	....
2 in.	67	40½	63	36½
2½, 3 in.	67	40½	66	39½
3½, 4 in.	....	....	66	39½
4½, 5, 6 in.	....	....	63	36½
7, 8 in.	....	....	60	33½

Wrought Nipples.	
4 in. and under	77½%
4½ in. and larger	72½%
4 in. and under, running thread.	57½%
Standard Couplings.	
4 in. and under	60%
4½ in. and larger	40%

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65%
Sq. Head Set Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45%
Flat & But. Head Cap Screws	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in. N.	70%
Semi-Fin. Nuts up to 1 in.	70%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

METALS.

	Montreal.	Toronto.
Lake copper, carload	$21 50	$21 50
Electrolytic copper	21 25	21 25
Castings, copper	21 00	21 00
Tin	45 00	46 00
Spelter	28 00	28 00
Lead	7 50	7 50
Antimony	40 00	40 00
Aluminum	40 00	40 00

Prices per 100 lbs.

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh	$20 00
Openhearth billets, Pittsburgh	20 00
Forging billets, Pittsburgh	25 00
Wire rods, Pittsburgh	25 00

NAILS AND SPIKES.

Standard steel wire nails, base	$2 40	$2 35
Cut nails	2 50	2 70
Miscellaneous wire nails	75 per cent.	
Pressed spikes, 5/8 diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	75
Stove bolts	80
Plate washers	40
Machine bolts, 3/8 and less	70
Machine bolts, 7-16 and over	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes	4¼c per lb. off
Nuts, Hexagon, all sizes	4¾c per lb. off
Iron rivets	72½ per cent.
Boiler rivets, base, 3/4-in. and larger	$3.25
Structural rivets, as above	3.25
Wood screws, flathead, bright	85, 10, 7½, 10 p.c. off
Wood screws, flathead, Brass	75 p.c. off
Wood screws, flathead, Bronze	70 p.c. off

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Standard. Price. per ft.	Extra Strong, Sizes Ins.	Extra Strong, Price per ft.	D. Ex. Strong, Size Ins.	D. Ex. Strong, Price per ft.
1/8in	$ .05½	1/8in	$ .12	½	$ .32
1/4in	.06	1/4in	.07½	¾	.35
3/8in	.06	3/8in	.07½	1	.37
1/2in	.08½	1/2in	.11	1¼	.52½
3/4in	.11½	3/4in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1¼in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.....
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....

COKE AND COAL.

Solvay Foundry Coke	$5.75
Connellsville Foundry Coke	4.85-5.15
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

IRON PIPE FITTINGS.

Canadian malleable, 35 per cent.; cast iron, 60; standard bushings, 60; headers, 60; flanged unions, 60; malleable bushings, 60; nipples, 75; malleable, lipped unions, 65.

MISCELLANEOUS.

Putty, 100 lb. drums	$ 2.70
Red dry lead, 100-lb. kegs, per cwt.	9.67
Glue, French medal, per lb.	0.18
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.18
Benzine, single bbls., per gal.	0.18
Pure turpentine, single bbls.	0.66
Linseed oil, raw, single bbls.	0.73
Linseed oil, boiled, single bbls.	0.76
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Lead wool, per lb.	0.09
Pure Manila rope	0.16
Transmission rope, Manila	0.19½
Drilling cables, Manila	0.17½
Lard oil, per gal.	0.60

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto 40%

PROOF COIL CHAIN.

¼ inch	$8.00
5-16 inch	5.35
⅜ inch	4.60
7-16 inch	4.30
½ inch	4.05
9-16 inch	4.05
⅝ inch	3.90
¾ inch	3.85
⅞ inch	3.65
1 inch	3.45

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	60
Carbon over 1½ in.	25
High Speed	40
Blacksmith	60
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Centre	25
Pipe Reamers	80

Discounts off standard list.

COLD DRAWN STEEL SHAFTING.

At mill	40%
At warehouse	40%

Discounts off new list. Warehouse price at Montreal and Toronto.

TAPES.

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3.50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$3 00	$3 00
Canada plates, dull, 52 sheets	3 10	3 50
Canada plates, all bright	4 25	4 50
Apollo brand, 10¾ oz. galvanized)	6 40	6 40
Queen's Head, 28 B.W.G.	6 50	6 50
Fleur-de-Lis, 28 B.W.G.	6 30	6 30
Gorbal's Best, No. 28	6 50	6 50
Viking metal, No. 28	6 00	6 00
Colborne Crown, No. 28	6 30	6 30

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$10 00	.....
1¼ in.	10 00	.....
1½ in.	10 00	.....
1¾ in.	10 00	.....
2 in.	10 50	9 20
2¼ in.	12 10	.....
2½ in.	13 05	12 10
3 in.	15 75	12 70
3¼ in.	.....	13 90
3½ in.	20 00	15 00
4 in.	25 50	18 90

Prices per 100 feet, Montreal and Toronto.

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50 & 10%
Standard	60%
Cut leather lacing, No. 1	$1.20
Leather in sides	1.10

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	$9.00
¼ in.	6.25
5-16 in.	4.65
⅜ in.	4.00
7-16 in.	4.00
½ in.	4.00

Prices per 100 lbs.

WASTE.

WHITE.	Cents per lb.
XXX Extra	0 10¼
X Grand	0 09¾
XLCR	0 09¼
X Empire	0 08½
X Press	0 07¾
COLORED.	
Lion	0 07⅛
Standard	0 06⅜
Popular	0 05¾
Keen	0 05¼
WOOL PACKING.	
Arrow	0 16
Axle	0 11
Anvil	0 08
Anchor	0 07
WASHED WIPERS.	
Select White	0 09
Mixed Colored	0 06¼
Dark Colored	0 05¼

This list subject to trade discount for quantity.

BELTING RUBBER.

Standard	50%
Best grades	30%

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Toronto, Ont., July 13, 1915. — War orders are the principal feature of interest in business circles and it is generally thought that large contracts will be placed in Canada for military equipment and supplies. The placing of the C.P.R. Purchasing Department at the service of the British Government will facilitate the purchase of supplies and also stimulate business in this direction. Manufacturers have now another organization to deal with in addition to the Commission appointed by the Canadian Government. The result of all this endeavor cannot but be of the greatest benefit to many Canadian manufacturers and a stimulus to a variety of industries. The foregoing is altogether apart from the shell industry, which of course is under the direction of the Shell Committee. In this regard, however, Russian and French shell orders have to be considered, as big business may eventually result. Contracts for Russian shells have of course already been placed, while an order for French shells is already on the tapis.

Taking everything into consideration, the outlook has during the last few weeks improved considerably, and indications point to a more extensive development in trade than was perhaps anticipated during the earlier stages of the war.

The Export Association of Canada which was recently organized and which

has its headquarters in Montreal, is endeavoring to enlist the support of the leading Toronto manufacturers. A conference was held here last week for this purpose. The Association was formed with a view to developing the export trade of Canada and to take as full advantage as possible of opportunities for trade that will arise during the period of reconstruction that will follow the war.

Steel Markets.

The shell industry continues to dominate the steel trade and production is being speeded up to meet the demand. Activity has spread to the steel foundries where blanks are being cast for the 4.5 shells, preparatory to forging, thus giving additional work for the forging plants. The demand for merchant bars is still light, and the outlook in the steel trade as regards ordinary business is improving and prices are very firm. Canadian mills have advanced prices on iron and steel bars to $2.20 f.o.b. Toronto.

The market for galvanized sheets is easier, but prices are practically the same as at the last advance; only a few makers of galvanized sheet products are offering material on account of the continued high price of spelter. Makers of tool steel are much concerned over the great scarcity of tungsten, one of the chief ingredients of high-speed steels. The price of this alloy has advanced considerably and tool steels are higher proportionately. The big demand for high-speed steel for tools and drills makes the situation more acute.

Further improvement in the steel trade is reported from United States centres. The export trade continues to develop, while the domestic business is also improving. Prices are very firm at the recent advances, and it is expected that present quotations will be maintained, if not further advanced.

Pig Iron.

There is no improvement in the pig iron situation as regards foundry requirements, although the blast furnaces at the steel plants are in active operation. Prices are unchanged.

Scrap Metals.

The market is firm for copper and brass scrap, and the demand continues good. Heavy melting steel is more active and prices are firmer. Scrap zinc and lead are quiet but unchanged.

Machine Tools.

The situation in the machine tool trade is practically the same as last week, fewer inquiries have been received ed by local dealers, but they are busy filling orders already placed. The absence of contracts for shells has been satisfactorily explained and further orders will be placed as soon as the firms making cartridge cases, etc., can meet the demand so that fixed ammunition only will be shipped to England. Interest will be centred on 18 pdr. and 4.5 high-explosive shells when the activity is renewed, and there will be a good demand for the necessary machines and tooling fixtures. Many makers of machine tools are booked up for months ahead, and prices are advancing.

Supplies.

Business continues to be very satisfactory with an increasing demand in connection with making shells. Chucks, collapsible taps, twist drills, reamers, belting, cutting compound, etc., are all in good demand. The only price change of importance to note this week is in iron pipe fittings, which have advanced. The new discounts are as follows: Canadian malleable, 25 per cent. for A, and 35 per cent. for B and C classes; cast iron, 60 per cent.; malleable bushings, 60 per cent., and standard bushings, 60 per cent.

CANADIAN GOVERNMENT PURCHASING COMMISSION.

The following gentlemen constitute the Commission appointed to make all purchases under the Dominion $100,000,000 war appropriation:—George Gault, Winnipeg; Henry Laporte, Montreal; A. E. Kemp, Toronto. Thomas Hilliard is secretary, and the commission headquarters are at Ottawa.

Metals.

There is nothing of particular interest to note in the metal market this week. Prices are at the same level and generally steady. The situation locally continues undisturbed and the demand for metals for munitions is unabated. Ordinary business appears to have improved, but is hardly up to the normal. A scarcity of spelter and aluminum exists with no expectation of any relief for some time. The Imperial Government has placed an embargo on the exportation from Great Britain of all metals necessary in the manufacture of munitions.

Tin.—The market weakened slightly at the end of last week but has recovered and is now firmer and quiet. The present consumption of tin is very large and will continue to be so for some time. Quotations are unchanged at 46c per pound.

Copper.—The market is quiet and the tone is inclined to be easier. The copper situation, however, is a strong one and with consumption on the increase any change in price will probably be upwards. Local quotations are unchanged at 21½c per pound.

Spelter.—The market is steady but the general situation has not improved. There is good business being done in all positions up to the end of the year and some of the export orders go into the first quarter of next year. Quotations are nominal at 28c per pound.

Lead.—The market is dull and easier but quotations are unchanged. The lead situation is improving gradually and an upward movement is expected in some qparters. Lead is quoted locally at 7½c per pound.

Antimony.—The market is quiet but the demand is somewhat better, although prices have an easier tendency. Quotations are nominal at 40c per pound.

Aluminum.—The scarcity of supplies of aluminum is still felt, and prices are being maintained at the present unusually high level. Quotations are nominal at 40c per pound.

St. John, N.B., July 10, 1915.—Friends in the manufacturing trade throughout the Eastern Provinces will join with many others in extending congratulations to Hon. John E. Wilson, M.P.P., upon his appointment to the important position of deputy receiver-general and manager of the Government Savings Bank in this city. The appointment was recently announced. Hon. Mr. Wilson is president of the firm of J. E. Wilson, Ltd., iron founders and sheet metal workers. He has been prominent in local business and political circles for many years. Hon. Mr. Wilson was for some time a member of the old common council, and in 1908 was elected to a seat in the Legislature at Fredericton, being re-elected in 1912. He was then made a member of the cabinet without portfolio, and was also chosen president of the legislative council. He will now quit public life and retire to the quieter precincts of the civil service in an office well deserved after his years of service to the Conservative party.

The big spandril arch bridge, the largest in the world, across the Reversing Falls, St. John, N.B., will soon be thrown open to the public. The flooring was finished this week by A. R. C. Clark & Son, and the approaches will be finished in the near future by J. McVey & Son. The new bridge is of steel and is a magnificent and inspiring structure.

The contract for the substructure and approaches of the new highway bridge over the Petitcodiac river at Moncton, N. B., has been awarded to Engineers and Contractors, Ltd., a Nova Scotia concern. L. A. Keith is at present acting as their agent in this city. The president of the firm is E. R. Reid of Annapolis, N.S., while his partner is E. M.

Archibald, a graduate in engineering, from McGill University, and also residing in the Annapolis valley. Work has been started on the bridge, and will be rushed to completion as rapidly as the circumstances warrant.

The Maritime Dredging & Construction Co. is setting forms in place along the top of No. 1 extension, West St. John. Concrete will later be poured into the wall until it is elevated to a level with the new docks. This wall, known as the "Connolly Dock," is 300 feet in length and about six feet below the required height.

Miles E. Agar, hardware manufacturer, of St. John, and Matthew Lodge, of Moncton, N.B., have left for England to confer with the directors of the Maritime Oil Fields, Ltd., respecting the extension of a lease of the oil and gas privileges of the New Brunswick Petroleum Co., now held by the former concern. The lease is just expiring, and Messrs. Agar and Lodge plan to consult about its extension and enlargement.

TRADE WITH RUSSIA PROSPECTS.

GREAT possibilities for Canadian trade with Russia are revealed in the first report sent by Special Trade Commissioner Conrad F. Just to the Department of Trade and Commerce.

Mr. Just has concluded his investigations in the Petrograd district, and is now working south and east. He has had a number of conferences with members of the Russian Government and with leading bankers, having had considerable assistance from the British Commercial Attache and British Consul at Petrograd. He points out that at the outbreak of the war, Germany, after 25 years of effort, had to her credit 52 per cent. of the import trade of Russia. Since the war, the conventional tariff rates have been withdrawn, the general tariff increased by 10 per cent., and a surtax of 100 per cent. imposed against Germany and Austria. The war has not devastated any true Russian areas, but districts which constituted the base of the German economic penetration of Russia.

Russia, says Mr. Just, has great powers of recuperation, is internally rich and prosperous, and affords "great opportunities for industrial enterprise for which the consuming power is at hand." These factors, the report states, should make Russia a great market, "and if the conditions be rightly studied and understood, Canadian manufacturing industries, by the nature of the products, which are adapted in so many instances to the requirements of a developing country like Russia, may reasonably expect to participate in the trade with that market."

Agriculture is the occupation of 85 per cent. of the Russian people, and the manufacturing industry furnishes an insignificant output in relation to the country's needs.

Canadian Exports Confused.

Mr. Just says that Canadian machinery exports to Russia have been confounded with those from the United States. He advises Canadian traders to organize on the basis of a close study of the Russian requirements and to keep in touch with the consumer by means of local agents, who play a very prominent part in connection with the foreign trade of Russia. Firms seeking trade with Russia should enter the market in groups or syndicates, this being possible when the products of such firms do not compete, but are complementary to each other. It is also desirable to have assembling shops in Russia, particularly for machinery, thus saving on Customs duties and permitting tendering on Government works. A start should be made in Petrograd, where the Russian fashions are set.

"The successful participation of Canada in the contracts of the Russian Government for munitions of war, railway rolling stock, and it is believed for locomotives and other materials, has created lively interest in Russian official banking and commercial circles," says the report, "and should prove an excellent advertisement of the capabilities of the Canadian industrial system."

Canadian leather supplies, it is added, would be snapped up at high prices. "A pair of Russian army boots has a life of two months."

SHELL MANUFACTURERS IN CONFERENCE.

FULL information with regard to the shell-making capacity of Canadian industries will be placed before the British Government's representative, Mr. Thomas, who is expected to reach Ottawa some day this week. With this object in view, a number of leading manufacturers have held a meeting here in conference with members of the Shell Committee. There were present T. A. Russell, of the Russell Motor Car Co.; Wm. Inglis and Campbell Rives, of the John Inglis Co.; Mr. Findlay, of the Massey-Harris Co.; Mr. Gurney and Mr. Tinson, of the Crocker Wheel Co.; Alex. Goldie, of Goldie and McCullough; Col. Frederick Nicholls, of the Canadian Allis-Chalmers Co.; Robert Hobson, of the Steel Company of Canada; Mr. Niven, of the Otis Fensom Co.; Col. J. B. Miller, of the Polson Iron Works, Gen. Bertram and other members of the Shell Committee.

It was explained by Col. Nicholls that the meeting had been called for the purpose of considering what more could be done to relieve the ammunition shortage in view of the approaching visit of Mr. Thomas. Large sums of money would be spent if necessary on equipment for turning out completed shells on a large scale.

It was sugested by Mr. Findlay that, through the proper medium, the Shell Committee, a delegation of manufacturers should meet Mr. Thomas and discuss the situation with him. He thought that if fixed ammunition is required, assembling plants should be established on a large scale, so that larger orders could be undertaken.

Mr. Nicholls stated that they had received proposals to take foreign orders, but preferred to wait for orders from the War Office through the Shell Committee. Larger orders would enable the manufacturers to invest capital in additional equipment without the danger of the work being insufficient to warrant the outlay. He suggested that the Government or the Shell Committee should establish a large assembling plant or, if not, the manufacturers were prepared to do it.

It was proposed by Mr. Russell that a statement be prepared for Mr. Thomas, showing the number of firms ready to undertake shell manufacture on a large scale, with details as to which of these firms would undertake the machining of shells, the manufacture of cartridge cases, of primers, and so on.

General Bertram assured the meeting that the War Office was prepared to place further and larger orders with the shell committee as soon as it could be shown that the work could be done. General Pease had assured him that Canada could secure all the orders necessary as soon as the manufacture of cartridge cases and the loading capacity warranted the placing of further orders. General Bertram explained the difficulties that had arisen in connection with the manufacture of cartridge cases and the loading.

The meeting ended after a full and exhaustive discussion and with the suggestion that the manufacturers co-operate with the Shell Committee in conferring with Mr. Thomas.

CANADIAN MINERAL PRODUCTS FOR BRITAIN.

THROUGH the medium of the High Commissioner's Office, trial orders have been given by the British authorities for certain Canadian mineral products found in Ontario and Quebec, and those who grumble about Canada's share of war contracts have no conception of the large orders already passed, at least so we are given to understand. The Imperial Government is adopting the policy

of giving the Dominion every possible chance.

Col. Pelletier, agent-general for Quebec, is also supplying certain minerals from Quebec to the French analysts, who hold out great hopes of utilizing the same for war munitions.

BRITISH OPENING FOR SAW-MILL MACHINERY.

MANUFACTURERS of saw-mill and woodworking machinery may be interested in Trade Inquiry No. 831, which has been received from Harrison Watson, Trade Commissioner at London, notifying the Department of Trade and Commerce, Ottawa, of the name of a firm, who are large manufacturers of saw-mill and woodworking machinery. As their own plant is heavily engaged in Government work, and as they are receiving inquiries from all parts of the world which they cannot deal with themselves, they are prepared to receive complete information from any Canadian manufacturers of saw-mill and woodworking machinery, to enable them to negotiate for orders without being obliged to refer any further to Canada. They wish to be placed in the same position as that in which the manufacturer would put his traveller or agent. Canadian manufacturers, wishing to avail themselves of such an opportunity may be supplied with the name of the firm by applying to the Department of Trade and Commerce, Ottawa. (Refer File No. 810).

MARKET FOR WIRE RODS IN BRITAIN.

CONSIDERABLE quantities of wire rods have hitherto been sent to the United Kingdom from Germany, and as supplies have now ceased, consumers are experiencing much difficulty in obtaining adequate supplies from home sources. Another factor which is handicapping producers is the difficulty of securing labor, as so many skilled men have enlisted in the army.

If Canadian manufacturers are able to export these rods, the information ascertainable covering the following particulars may be of service. The rods required should be of soft and hard steel and in what is known to the trade as 4, 5 and 6 gauge. The soft steel rods should have 0.10 per cent. carbon, and the hard steel rods 0.40, 0.50 and 0.60 per cent. carbon. The soft rods are intended to be drawn into wire for the making of such articles as boot rivets and wire mattresses, while wire obtained from the hard rods is used among other purposes for card clothing and also for wire rope making.

Maxville, Ont.—The Borden Milk Co. contemplate the erection of a condensed milk factory here.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Smith's Falls, Ont.—The Frost & Wood Co. have received an order for making shells.

Brampton, Ont.—It is reported that the Pease Foundry Co., have received an order for shells.

Montreal, Que.—W. A. Dean, of Toronto, will establish a plant for building flying machines near Montreal.

Corbyville, Ont.—The H. Corby Distillery Co. are in the market for a motor-driven pump and an air compressor.

Gananoque, Ont.—The Steel Co. of Canada, Ltd., will probably build an extension to their plant at this place. Head office is at Hamilton, Ont.

Chatham, N.B.—The Maritime Foundry Co., are erecting a factory to make shells. The building will be 80 x 40 feet and will cost about $40,000.

Toronto, Ont.—The Board of Control has instructed Works Commissioner Harris to report on the cost and advisability of building car shops in this city.

Paris, Ont.—The Bell Foundry Co. of St. George have installed a complete machinery equipment for the manufacture of shells, and they commenced operations this week on a large order.

Sherbrooke, Que.—The City Council has decided to proceed with the erection of the new gas plant at an estimated cost of $75,000. Tenders for one gas holder will be accepted in the meantime.

Smith's Falls, Ont. — The Frost & Wood Co. have received an order for shells to the extent of $100,000. The company will install additional machinery. The initial outlay for the equipment will be $25,000.

Toronto, Ont.—The Chevrolet Motor Co., of Canada, Ltd., which has recently been incorporated with a capital of $50,000 will establish a plant here. W. C. Durant, president of the Chevrolet Motor Co., New York City, is interested in the Canadian concern.

Electrical

Smithville, Ont.—The installation of an electric lighting system is under consideration.

Kincardine, Ont.—The council will purchase a number of 60-watt lamps.

Orillia, Ont. — The Orillia Water, Light and Power Commission will extend their transmission lines to Longford.

Toronto, Ont.—The Parks Committee has decided to put cluster lights on University avenue, so that men who have to work by day will get a chance to drill in the open at night. This work will cost $12,000.

Orillia, Ont.—The Orillia Power Commission will probably be able to supply Longford with electric current after all, an alternate route having been secured through Orillia township to Washago and thence to the Standard Chemical Co. works at Longford. John McRae of Ottawa, is consulting engineer for the commission.

Municipal

Burlington, Ont.—The town will raise $50,000 for the proposed sewage system.

Hamilton, Ont.—Fire Chief Ten Eyck has recommended the installation of several fire alarm boxes.

Sackville, N.B.—The Town Council are contemplating additions to the waterworks plant. A pump may be required.

Pembroke, Ont.—The Town Council are considering the purchase of a combination hose wagon and chemical engine. Clerk, A. J. Fortier.

Toronto, Ont.—The Board of Control has decided to proceed with the construction of the new street railway tracks on Bloor street west.

Montreal, Que.—The Controllers reported to the council that a by-law should be adopted without delay to vote a sum of $1,000,000 for needed improvements to the waterworks. In addition to this sum an additional amount of $74,000 is required to expropriate land for waterworks extension purposes, land not ceded to the city.

Hamilton, Ont.—The construction of a reservoir with a capacity of 17,500,000 gallons, and provision for eventually increasing the maximum capacity to 50,000,000 gallons, is recommended by Kerry & Chase, of Toronto, the engineers who have been investigating the possibilities of economizing in the operation of the water works system.

Sarnia, Ont.—The Sarnia Gas & Electric Light Co. has received from the City Council an offer for its entire electrical plant, lines and properties, the sum offered by the corporation being $155,000, which represents the figure advised by Engineer Jeffries, of the Hydro Commission, who some time ago made an estimate of the whole situation. If the company will accept this figure the council will have a by-law prepared to submit the question to the ratepayers.

Mimico, Ont.—The New Toronto Council have definitely decided to link up with Mimico and construct a sewage system and disposal plant which will accommodate the needs of both municipalities. The disposal plant will be built in Mimico, but the council refuse as yet to disclose its exact location. The pump house, a portion of the new works will, however, be constructed at the lower end of Superior Avenue. The cost of the new system will amount to about $50,000, according to the estimates of the engineers.

General Industrial

Peterborough, Ont.—Fire has destroyed the brick plant of Curtis Bros.

Montreal, Que.—The A. Racine Co. are building a carriage factory here.

Martintown, Ont.—A. E. Clingen's sawmill has been destroyed by fire. Loss, $7,000, partially covered by insurance.

Fort William, Ont.—The Ogilvie Milling Co., are considering making an addition to their elevator here which will increase the capacity by 750,000 bushels.

Preston, Ont.—The Hurlbut Shoe Co., which was given a loan of $25,000 from the town, has plans drawn for a three-storey building on Queen street, near the present factory.

Lethbridge, Alta.—It is possible that the Taylor Milling Co. and the Lake of the Woods Co. may erect elevators at Foremost. There are already elevators of the National Grain Co., and the Farmers' Co-Operative Elevator Co. at this point.

Tenders

Ottawa, Ont.—Tenders on the supply of transformers, switches, and equipment will be received until August 3 by the chairman of the Waterworks Commission. Plans and specifications with the city engineer, R. L. Haycock.

Ottawa, Ont.—Tenders will be received until August 3 for high-lift pumps and motors for the Lemieux Island pumping station. Plans and specifications may be obtained from the consulting engineer, S. B. MacRae, Ottawa.

Oakville, Ont.—Tenders will be received by the chairman of the Oakville Water and Light Commission until Monday, July 26, 1915, for furnishing and installing one electrically-operated turbine pump of 600 Imperial gallons capacity against a head of 300 feet. Specifications may be seen at the office of the Commissioners, Oakville, or at the office of Chipman & Power, engineers, Mail Building, Toronto.

Building Notes

Toronto, Ont.—J. W. Siddall, architect has taken out a permit for a factory to cost $7,000 at 71 Sterling road.

Toronto, Ont.—H. T. LePage has taken out a permit for the erection of a concrete block factory on Dundas street to cost $10,000.

Barrie, Ont.—The general contract for the new Carnegie Library has been let to the Ball Planing Mill Co., of this town. Chapman & McGiffin, of Toronto, are the architects.

Toronto, Ont.—The city architect has issued permits for additions to two public schools, the Searth road school to cost $22,000, and the St. Clair avenue school to cost $27,300.

Toronto, Ont.—The Borthwick Baking Co. have been granted a permit by the City Architect's Department for the erection of a two-storey addition to their factory on Davies avenue. The work will cost $14,000.

Port Colborne, Ont. — The School Board has adopted the plans for the proposed new school on Steele street which is estimated to cost $35,000. Architect Porter of Niagara Falls, Ont., will prepare specifications, etc.

Vancouver, B.C. — The Merchants Bank has awarded a contract for the erection of a headquarters building in this city, to cost $175,000. It will be of four stories, and will be located at the corner of Pender and Granville streets.

Vancouver, B.C.—Work will start immediately on a three-storey building for the Merchants Bank at Granville and Pender streets, which will cost when completed approximately $175,000. The plans have been drawn up by Somerville & Putnam, architects, of this city.

Railways-Bridges

Vanconver, B.C.—It is announced that the main line of the Canadian Northern Pacific Railway will be ready for operation by September.

Toronto, Ont.—The York County Council has granted a sum of $2,000 towards the construction of Jersey Bridge at North Gwillimburg.

Toronto, Ont.—The York County Council has under consideration the construction of a bridge at Locust Hill, the estimated cost being $20,000.

St. Thomas, Ont.—The London & Port Stanley Railway Commission will in a few days commence the erection of a new station and office building, on Talbot street.

Calgary, Alta.—The City Council are considering the question of extending the street railway tracks to the Sarcee military camp. The citizens are in favor of the extension.

Brantford, Ont.—The electrification of the Lake Erie & Northern Ry. from Port Dover to this place will be proceeded with during the summer. Rolling stock will be purchased.

Calgary, Alta.—George H. Webster has been given the contract to build the Spirit Lake-Grand Prairie branch of the Edmonton Dunvegan and British Columbia Railway, now under construction by J. D. McArthur.

London, Ont.—The London & Port Stanley Railway Commission have closed the deal for the Gootson property on Ottaway Avenue, for car shops. Possession will be given at once, and the work of erecting the buildings will commence shortly.

Arnprior, Ont.—The new bridge to be erected over the Madawaska river at Burnstown by the county council and township council of McNab is to cost in the neighborhood of $26,700. It will be of cement and concrete, and its length will be over 300 feet.

Brantford, Ont.—The offer by the city of the sale of the Grand Valley Railway line from Paris to Galt for $30,000 and electrification of the L. E. & N. Railway, from Port Dover to Brantford has not been accepted by M. H. Todd, General Manager of the Lake Eric. He offered $26,000, the city to retain the Galt powerhouse. He will submit the city's offer to the C. P. R. board, but will not recommend it.

Chatham, Ont.—The Hydro-Electric Power Commission of Ontario is negotiating with the C. N. R. for the purchase of the Chatham, Wallaceburg and Lake Erie Railway, which runs from Erie Beach on the south to Wallaceburg on the north. If purchased, the line will be made the nucleus for a hydro radial system in this part of the province, and the road will be extended to Sarnia through Petrolea and other places about to instal Niagara power.

Brantford, Ont.—The city's offer to the Lake Erie & Northern Railway, through the C. P. R., to sell the Grand Valley Railway from Paris to Galt, has been accepted. The price, it is understood, was $26,000. This means that the Lake Erie & Northern Railway will be electrified from Brantford to Port Dover. This gives electrical railway communication with Lake Erie. Orders for electrifying material will be placed at once and work will be rushed.

Lake Superior Division, G. T. P.—The Lake Superior division of the G. T. P. was taken over by the Government on July 1 under lease, and will be operated as part of the National Transcontinental Railway. The rental as announced previously is $600,000. The Grand Trunk Pacific Railway system now stops at Winnipeg. Hitherto it extended virtually to Fort William via the Lake Superior division, the intervening National Transcontinental link between Graham and Winnipeg having been used by the G. T. P. under a lease from the Government. All the lines east of Winnipeg will now be operated by the Government, the G. T. P. eastbound traffic at Winnipeg being taken over by the Transcontinental.

New Incorporations

The Bull Tractor Co. has been incorporated at Ottawa with a capital of $25,000 to manufacture gas tractors, gas engines, motor trucks, motor cars, etc., at Winnipeg, Man. Incorporators: Garnet Coulter and Percy John Procter, of Winnipeg, Man.

The Nitrogen Products, Ltd., has been incorporated at Ottawa with a capital of $300,000 to manufacture by electrical or other method atmospheric nitrogen, nitric acid and nitrates of all kinds at Toronto, Ont. Incorporators: William Bourne, and William John Lockwood McKay, of Toronto.

Principles of Design and Lubrication of Bearings

By Frank Foster, M.Sc.

The subject matter of the accompanying article is such as will prove both interesting and instructive to machinery designers and operators. Not a few plain definite statements are made relative to bearing metals and to the means employed to secure efficient lubrication of a journal when carrying its normal load, all of which give food for thought and stimulate a desire to more fully grasp the essentials of these important engineering problems.

DESIGN AND LUBRICATION OF BEARINGS.*

By Frank Foster, M.Sc.

BEARINGS are almost entirely designed according to various empirical rules. Certain general principles based on experimental evidence and reasoning can profitably be associated with these empirical rules, and in some instances current practice may thus be modified with advantage.

Engine lubrication consists in separating two metallic surfaces by means of a film of fluid, usually oil. With perfect lubrication the metallic surfaces do not touch at all, and no wear takes place. Usually, even with the best of lubrication, metallic contact occurs on starting up and sometimes continuously on high spots until these are rubbed down. To avoid spot contract, careful bedding is necessary, especially on large bearings. With imperfect lubrication, such as is usually the result with drip feeds, the oil film is thin and liable to be broken, permitting intermittent or local metallic contact and wear. The laws governing such restricted lubrication are available and differ from those for perfect lubrication. Most empirical bearing rules date back to the days of drip and other forms of imperfect lubrication. Hence it is often possible to revise these old rules, but in doing so the chances of damage are more serious if the full oil supply fails for any reason. For this reason some authorities urge that bearing design should be based on imperfect lubrication, but this is not accepted by designers of turbines and other modern high-speed machinery.

Bearing Load.

The load a bearing can carry when working normally is a matter of viscous hydraulics and not of bearing metals. Bearing metals are important from reasons of manufacture or repair, and in case the lubrication becomes faulty. Lubrication being a matter of hydraulics, correct conceptions of bearing phenomena can best be obtained by thinking of oil as flowing through the extremely shallow, but relatively wide channel between the two bearing surfaces. Looked at from this point of view certain conditions are evident.

1—Oil should be supplied to points at which there is no bearing pressure.

2.—Escape of oil should be prevented except at the proper delivery edge.

3.—The relationships between bearing pressure, speed of flow, thickness of oil film, and viscosity of oil will depend largely on the rate at which the oil is supplied to, and can escape from, the bearing.

4.—The oil film is under the pressure due to the load, and hence the oil must be drawn or forced into the bearing by some means or other.

5.—The physical properties of the bearing metal are relatively unimportant during normal working.

The most important general principle is that stated in (4). With very rare exceptions bearings are their own pumps. The one notable exception is the footstep bearing of the vertical Curtis steam turbine, where the rotor floats on liquid supplied under heavy pressure. In all usual cases of so-called "forced lubrication" the pressure merely ensures that the oil reaches the supply inlet of the bearing. The bearing itself pumps or draws the oil from the supply pressure of a few pounds per square inch to several hundreds.

Bearing Pumping Action.

The natural pumping action of a bearing may be either (or both) of the following kinds:—

1.—The oil adheres to the moving surface, such as the shaft journal, and is dragged into the narrow channel between the (so-called) rubbing surfaces.

2.—The oil is sucked into a portion of the oil channel which is under negative pressure, and upon the reversal of the load is brought under pressure.

Regarding the first of these natural pumping actions, the following considerations apply:—

(a)—The inlet edge of the bearing must be bevelled so as to facilitate intake of oil and not to scrape it off the journal.

(b)—The load the bearing will carry is limited by the outflow or escape of oil previous to reaching the natural delivery edge. This outflow increases with undue clearance, short necks, badly placed oil grooves, low viscosity of oil, and high bearing temperature (this reduces the viscosity), and is very detrimental to good lubrication.

Oil grooves are ill understood and often placed so as to be worse than useless. They have only two proper functions:—To supply oil to suitable local inlets of the bearing and to form closed reservoirs or advanced supply depots, from which more advanced portions of the bearing can be lubricated. All oil grooves should be well chamfered at the delivery, or outflow, edge. This is most important.

Typical Bearing Examples.

A few typical bearing examples will serve to illustrate some of the above points

1.—For a rotating journal under steady load, such as dynamo journals, the oil should be fed to the top or sides where there is no pressure; ring lubrication, therefore, gives good results.

2.—For an oscillating journal under steady pressure, such as the crosshead pin of some single-acting engines, oil should be supplied at the sides, where there is no pressure. Part of the oil dragged in by the journal adheres to the bearing, which passes it on again to the journal higher up on the return oscillation. A closed oil groove (with chamfered edges) parallel to the axis of the journal, and some little distance in from the inlet edge, acts as an advanced supply depot.

3.—Is similar to 2, but with the load alternating in direction; as in the usual crosshead pin. In this case the pin itself pulses fore and aft and acts as a pump plunger. The oil inlet in this case may profitably be in the line of pressure, as it has to feed rapidly during suction; but side feed to the neutral regions is good in many instances.

4.—For a reciprocating bearing under fairly steady pressure, as a crosshead slipper and slide, the inlet to the oil channel between the rubbing surfaces

*From a paper on "Essential Principles of Engine Design" read before the Manchester Association of Engineers.

should be well chamfered, and drip, oil groove, or other feed to intermediate parts of the slide is desirable.

It will be noticed that since the oil is being squeezed out of a bearing, the thickness of the film must decrease from the inlet until near the outlet. In fact, without this, lubrication is very imperfect; and for this reason parallel rubbing surfaces, such as collar thrust bearings, are very difficult to lubricate. By adjusting these rubbing surfaces to give a succession of tapering oil channels with suitable feeding arrangements, this difficulty can be overcome and loads greatly increased without risk. This principle has, in fact, been successfully applied in practice. In the case of ordinary shaft bearings the wedge, or taper formation of the oil channel, is the result of the journal settling itself eccentrically in the bearing.

Professor Alexander deduces from theoretical considerations that the clearances between similar bearing surfaces for machines of the same form and duty should vary as the square root of the journal diameter, or equivalent linear dimension. This is contrary to usual shop rules, but it is interesting to note that practically the same law was worked out from experience and general considerations by the author more than a year ago. This is shown by Table I., showing allowances on diameter in thousandths of an inch for copious lubrication. With drip feeds smaller allowances are desirable.

Table I.—Crankshaft and Crank Pin Journal Allowances.

Diameter, inches	25	20	15	12	10	8	5	3	2
Proposed allowance	12	11	10	9	8	7	6	5	4
Theoretical allowance	12.6	11.3	9.8	8.75	8	7.15	5.65	4.4	3.6

The usual principle adopted in engine design is to allow certain pressures on the various journals. Tables II. and III. give usual practice, pressures being calculated on total piston load without modification for angularity of rod and inertia.

Table II.—Horizontal Engine Bearing

Bearing.	Lbs. per sq. in.
Crosshead pins	1,200—1,300
Crank pins	800— 950
Crankshaft journals (steam load)	100— 150
Crankshaft journals (combined loads)	150— 200
Second motion bearings	100— 200
Crossbead slides	40— 50
Intermediate piston rod slides	20— 40

Inertia should be allowed for in special cases. Journal speeds are rarely taken into account, but there is at present a tendency to do so, especially in Germany. The influence of speed is complex. In many cases it improves the load which can be carried, but it also increases the heat developed per second, and where the pressures are not such as to endanger the oil film, may limit the safe load on the bearing by the tendency towards overheating. For this a rule of the form—

Pressure per square inch $\times$ journal speed in feet per second $=$ Constant

is used, but the "constant" varies so widely that its value in the present state of knowledge is limited.

Table III.—Usual Bearing Pressure for Vertical High-Speed Engines.

Bearing.	Lbs. per sq. in.
Main bearings	200—300
Crank pins	400—550
Crosshead pins	1,000—1,200
Crosshead slippers	40—50
Eccentric straps	60—70

Bearing Metal Choice.

The choice of a bearing metal is determined probably more by abnormal working conditions than by normal. When working normally with a plentiful supply of oil the bearing and its journal are not in metallic contact, and the composition of the bearing metal is of practically no moment provided that the steps are sufficiently strong and rigid. On the other hand, the bearing metal becames an important factor in case of failure of the oil supply or overloading of the bearing. Metallic contact then takes place, and considerations of seizing, undue heating and melting out arise. The composition of the bearing metal has also an important bearing on questions of manufacture and repair, especially in the case of large bearings which call for extensive scraping and bedding. The extensive use of white metals is due to their merits under these heads rather than to any particular merits they may have under normal working conditions. In connection with white metals one important point may be mentioned. It is very important to secure close metallic contact between the white metal and the shell of the step so that disintegration is avoided and the heat necessarily generated in the bearing conducted away and radiated without undue temperature rise at the oil film.

HIGH EXPLOSIVE SHELL MANUFACTURE

At a time when high explosive shells are in such enormous demand, we feel says "Herbert's Monthly" that our readers would appreciate an outline of the operation methods which can be employed in making 18-pounder shell bodies, the size which is required in the greatest numbers. The design of these shells is such that the machining is not difficult, and rough material can be used in the form of pieces cut from the bar, which is therefore obtainable by anyone.

The chamber for the explosive being drilled from the solid, either a lathe or drilling machine can be employed for this operation. Further, the outside turning can either be done on engine lathes, or on turret lathes with a roller steady box-tool. It will thus be realised that the number of permutations of the operations by which the machining may be done is very great. We will however, confine ourselves to a description of three typical processes, any of which can be modified in detail according to the plant available. In all cases the material is best used in the form of blanks cut-off from bar, and consequently smaller lathes can be utilised than if the bar had to pass through the spindle.

The blanks can be cut-off on various types of machines, but it is worthy of note that the general practice is to partially cut-off a series of blanks from the bar in order that they can all be inspected and stamped at one time. They can then be broken off and used as required.

If the blanks were completely cut-off, the inspector would have to spend the whole of his time at the cutting-off machine to stamp each blank as it dropped off.

First Method

The first method employs a combination of engine, capstan, and turret lathes. The blanks are first centred at both ends on a centring machine, or sensitive drilling machine, and are then transferred to an engine lathe, where the outside diameter is rough and finish turned as far as the band groove, and the nose profile turned or formed. On being transferred to the next engine lathe, the remainder of the outside diameter is turned, and the large end faced to a definite length.

No. 1 hexagon turret lathes are employed for the next operation, where the shells are chucked nose end outwards, the hole drilled, bored, recessed and tapped. After this operation the shell is adjusted to a definite weight by facing off the closed end, after which it is transferred to a No. 4 capstan lathe, where the chamber for the base plug is bored and chased. The base plug is now inserted, cemented and riveted.

The succeeding operation on the bodies consists of forming the grooves for the copper band, which includes the machining of the waved ribs, and this is done on No. 4 capstan lathes. The chuck carrying the shell is fitted with a double sided former cam, and in the groove a peg fits which actuates the oscillating tool holder carrying the form tool. At the same operation the closed end of the shell is finish-faced. The copper band is next pressed on, and machined on any type of simple lathe with a form tool, a plug being fitted into the open end of the shell.

With regard to the manufacture of the base plugs themselves: these are

made from steel stampings, with either a hexagon or square head stamped on to enable them to be screwed home. A hexagon head is better than a square head, as it enables the stamping to be held in a three-jaw chuck. The actual machining is done on a screw-cutting lathe, fitted with a square turret.

In order to facilitate riveting, a groove is cut near the outside on the unmachined side, so that the edge can easily be turned over.

Second Method

By this method practically the whole of the work is done on capstan and turret lathes. The blanks are chucked in a No. 1 hexagon turret lathe, where they are drilled, bored, recessed, tapped, turned as far as the band groove with a roller steady box-tool, and the nose formed.

At the next operation they are held in a chuck on an engine lathe, the remainder of the outside diameter turned, and the closed end faced to length.

They are then adjusted for weight as previously described, and afterwards the chamber for the base plug is bored and chased on a No. 4 capstan lathe, the succeeding operations being exactly as described in the first method.

Third Method.

This method utilizes a combination of drilling machines, engine lathes and capstan lathes. The blanks are first roughly drilled on a drilling machine, and are afterwards transferred to an engine lathe, where the outside is rough and finish-turned true from the drilled hole, and one end faced. They are then chucked on a No. 1 hexagon turret lathe, where the bore is finished, recessed and tapped, and the nose formed.

The shells are next adjusted for weight, bored for the base plug, and the succeeding operations are the same as the two previous methods.

Use of Automatic Turning Machines.

In the three methods above described, automatic turning machines are not included, but a number of the operations are being performed on this type of machine, with a consequent low rate of labour cost. Both No. 4 and No. 6 automatic turning machines are equally suitable, and the two alternative tool arrangements usually employed are as follows:—

In one case the rough blanks are chucked, and at one setting the hole is drilled and bored, the outside turned as far as the band groove, and the nose formed. In this case, the recessing and tapping of the nose has to be done subsequently as well as the machining of the base plug end and the band groove.

In the second method, the blanks are delivered to the machine with the hole roughly drilled, and the outside rough turned true with the hole. On the automatic turning machine they are then finish bored, finish turned, and the nose formed. In this case also, the thread at the nose end is recessed and tapped subsequently, and the machining of the base plug end done on other machines.

The specifically mentioned machine tools in this article refer, we presume, to the classification adopted by the makers, Alfred Herbert, Ltd., Coventy, England.

BRASS MELTING QUERY.

HAVING seen a few copies of your publication and noticing some questions and answers in same, I am taking the privilege of asking a question re some metal I am having trouble with. This metal (brass) has been put through a fireclay-lined gas retort with a view to obtaining it in large quantities, the composition being: copper 85, lead 10, tin 5. We lose a lot of metal due to its sticking to the lining and also to its coming out mixed with same. Could you suggest a way of getting this metal free of slag or lining? We have put it through crucibles, and some of the metal goes to the bottom all right; still the top of the crucible has a very tough and spongy material, hard to make an opening into to get our melted metal free to pour, and leaving a lot of it still in this mixture. We have a great quantity of this material on hand, and are anxious to get the trouble solved.

We have tried charcoal as a flux, also salt, but get no better results, and were thinking of smelting it same as iron, having rolled a shell 6 ft. long by 30 in., and having brick-lined it. Would you advise this process, and could you give us a dimensioned sketch for its development? We are supplying air by electric fan, and, for air passage around shell, make a recess in the brick lining, so as to not be bothered cleaning out air holes in a circular pipe. These few points are mentioned so that they can be enlarged upon.—Subscriber.

SELECTIVE ASSEMBLY.

WHEN so-called interchangeable work has to be turned out on a large scale as in fuse manufacture, drawings are sometimes dimensioned in such a way that the limits allowed for variations in dimensions cross each other. For example, suppose that a plug having a nominal diameter of 1 in. is to fit into a hole 1 in. nominal diameter, the plug might be dimensioned 0.998 in. high, and 0.994 in. low, whereas the hole might be 0.997 in. low and 1.001 in high. In such a case the high plug would not go into the low hole on account of the limits crossing.

Work produced on this system is not truly interchangeable in the sense that any plug would go into any hole, and it is only possible to assemble such work as "selective assembly," or in the colloquial language of the workshop by "marrying" the parts. Selective assembly or "marrying" is permissible where all the parts are finally brought together in one place in which the final assembling is done, but would be quite inadmissible where spare parts had to be sent to replace any which might wear out, as under such a system there would be no certainty that the spare parts would go into place.

Fuse Manufacture

In fuse manufacture where fuses are finally assembled and examined once and for all, and where the parts do not afterwards need to be replaced, the system is found to be workable and is actually in common use, its advantages being that wider limits of error and therefore easier processes of manufacture are permissible than would be the case where absolute interchangeability is necessary. It will thus be seen that interchangeability in manufacture as commonly understood is of two kinds, viz., the selective and the absolute.

In these days of high-class manufacturing methods and improved processes it is a great question whether selective assembly should not be considered as a survival of old methods and as an unnecessary compromise, as it has been found by some of our best makers of articles produced in quantities, that, by laying out the processes of manufacture in advance under a thoroughly well-considered system, absolute interchangeability is obtainable at no greater cost and with much more satisfactory results than selective interchangeability.

The matter is one which has assumed very great importance recently owing to the fact that so many parts of fuses, shells and various mechanisms which have been required in large quantities for the purpose of the war have been given out for manufacture separately and to different makers all over the Empire, and elsewhere.

In some cases manufacturers of such parts have found that the limits allowed could be decreased with great advantage even from a manufacturing point of view and with the greater certainty that the parts when made would go together and produce the final mechanisms with less trouble at less cost and with better final results than by the selective method.

The matter is one worthy of the most careful attention of manufacturers before beginning to make tools, working gauges, and other appliances necessary for the proper production of repetition work.— Herberts' Monthly.

NEW PROCESS DEVELOPMENTS

Inventive Genius and Research Operate to a Dual End — They Aim to Improve What We Now Possess and Bring to Our Service Commodities Before Unknown

ECONOMY AND EFFICIENCY OF COPPER CYANIDE.*

By C. H. Proctor.

IN the past, copper solutions have been prepared with various materials. The majority of platers used so-called copper carbonate, which is in reality a sub-sulphate of copper, the metal contents of which vary from 45 to 52 per cent. Some platers are still preparing solutions with copper acetate, which tests in the neighborhood of 30 per cent. copper, and others are using cupri-cupro sulphite of copper, which is known in the market as red copper compound, testing about 40 per cent. copper.

Expensive Procedure.

Although the plater knew that of these materials the metal was the only ingredient of value to him, still he was forced to use such impure salts. He, of necessity, had to add about 50 per cent. of inert matter when using the so-called copper carbonate, 60 per cent. when using cupri-cupro sulphite of copper, and 69 per cent. when introducing acetate of copper. You can readily appreciate that, after a few additions of metal salts, the bath became filled with these inert salts and impurities, increasing the density of the bath to such an alarming proportion as to necessitate the dilution of the solution and finally the discarding of the plating bath. The plater realized that this was a most expensive operation, and has therefore looked for a material free from impurities which would make this waste unnecessary.

The silver plating industry first realized the enormity of this waste and silver cyanide has been used in the large silver plating establishments for the past generation or two, having displaced silver chloride and silver nitrate. The platers of copper, brass and bronze who had to deal with base metals have not given this wasteful practice the consideration it deserved, but as the plating of brass and copper is assuming such large proportions, the plater has been forced to give this matter his attention.

Every plater knows that no matter what copper salt is used in a cyanide solution, it must first be converted into a copper cyanide and then cut down with sodium cyanide to form the double sodium copper cyanide. He has endeavored to secure a chemically pure copper cyanide, as with such a material he would introduce into his bath only the active ingredients necessary for results, that is, metal and cyanide, and at the same time eliminate one operation—the conversion of the carbonates, etc., into copper cyanide.

Copper Cyanide Not New.

Copper cyanide is nothing new. It has been available for years, but unfortunately it could only be obtained at a price which made its use prohibitive. The plater has had to continue the use of impure salts. He has had to continue clogging up his solutions with dead salts, which, while they gave results for the time being, forced him to discard, or at least partially discard, the baths when they became too dense. Every plater knows that a dense solution is harder to manipulate and control, and that it requires more current to get a satisfactory deposit. He has had to contend with an unknown factor, the nature of which he had no way of determining. Recently, however, copper cyanide has been put on the market at a price which not only makes its use possible, but which actually results in a decided saving in chemical costs.

Copper Cyanide Chemically Pure.

Chemically pure copper cyanide, testing 70 per cent. copper, the balance of 30 per cent. being pure cyanogen, is now at the disposal of the plater. He knows that with such a chemically pure salt a solution can be made up which will contain only that which is necessary for results, and knowing this, the solution can be controlled with absolute certainty. As the plater is constantly striving to better his conditions and put his plating department on a sounder basis, it will only be a matter of a comparatively short time when this high grade metal salt will entirely displace the copper salts heretofore used in cyanide solutions.

Why should a plater continue using so-called copper carbonate, which contains about 50 per cent. impurities and which must first be converted into a copper cyanide, when he can introduce chemically pure copper cyanide into his bath direct, especially when a solution made up with chemically pure materials can be controlled with absolute certainty? When the bath needs metal, the plater adds it in the form of copper cyanide, and when it requires cyanide, he adds it in the form of sodium cyanide. In other words he is now able to make up a solution which will give the best possible results in the shortest time and remain constant and well balanced.

Chemically Pure Material Solutions.

In the solutions which I will prepare, I will confine myself strictly to chemically pure materials. The copper bath will be prepared as follows:—

Water	5 ounces
Copper cyanide	15 ounces
Zinc cyanide	5 ounces
Sodium cyanide	15 ounces

I will prepare the brass solution according to the following recipe:

Water	5 ounces
Copper cyanide	15 ounces
Zinc cyanide	5 ounces
Sodium cyanide	20 ounces

Of course, by the elimination of the inert salts, the solution will be less dense, the copper solution standing about 3½ deg. Baume. In making up a copper bath I have only used 6 ounces of chemicals per gallon, while to make up a solution of the same metal contents with copper carbonate, I would have to use over 12½ ounces of material per gallon, thus increasing the density over 100 per cent. To make up a copper bath of five gallons to contain the same amount of metal as this solution contains, it would be necessary to use 21 ounces of copper carbonate. To put this in solution so as to obtain sufficient free cyanide for results it would require about 42 ounces of sodium cyanide.

Baume Scale Solution Test.

It is time that the practical electroplater discarded the Baume scale as a test for solutions, as any material that is soluble in water adds to the density of the bath and the Baume scale, therefore, does not give the plater any idea of the condition of his solution. With the constant addition of metal salts which contain large proportions of inert matter, the density will rapidly increase, while the solution may be practically void of metal. The plater must use chemically pure materials or else discard the Baume scale as an index to the condition of his bath.

Relative Cost.

The cost of the copper solution is 12 cents per gallon, while to make up a solution with the same metal content, using so-called copper carbonate, would cost the plater about 25 per cent. more. When we take into consideration that many plants operate thousands of gallons of solution, this economy is a considerable item. On the face of it the metal cyanides appear more expensive. The market price of copper cyanide is from 42 to 45 cents per pound, while the

*From the Bulletin published by Lewis Institute, Chicago.

so-called copper carbonate is quoted at 14 cents per pound.

The plater must not lose track of the fact that copper carbonate or copper cyanide either, for that matter, has absolutely no value as such. It only becomes of value to him when put in solution with cyanide. It is here that the plater saves. He requires only about one-third the quantity of cyanide to put in solution a given amount of copper in the form of copper cyanide as compared with copper carbonate. For instance, the cost of one pound of copper cyanide (70 per cent. metallic copper) put in solution with sufficient free cyanide to obtain an immediate deposit is—

1 lb. copper cyanide, at 42c per lb. .	42c
1 lb. sodium cyanide, 29 per cent., at 22c. per lb.	22c
	.64c.

To put in solution the equivalent amount of metal in the form of so-called carbonate of copper, 50 per cent., you require—

1 lb. 6 ozs. copper carbonate at 14c. per lb.	19¼c.
2 lb. 12 ozs. sodium cyanide, 29 per cent., at 22c. per lb.	60½c
	79¾c

Current Density.

Another factor which must be considered is the current density. It is a well known fact that a dense solution requires a higher electrical pressure, as the inert matter from the metal salts acts as a retarding agent. Of course, the rapidity of the deposit is governed by the ampere law, which teaches us that the more amperes which can be carried upon a given surface the more rapid will be the deposit. The inert matter being eliminated by the use of the metal cyanides, the plater is able to increase the amperage about 25 per cent., and this enables him to reduce the time necessary for results, increasing the output accordingly. He, therefore, is able to turn out more work in a given time without increasing his tank area, which is another decided economy.

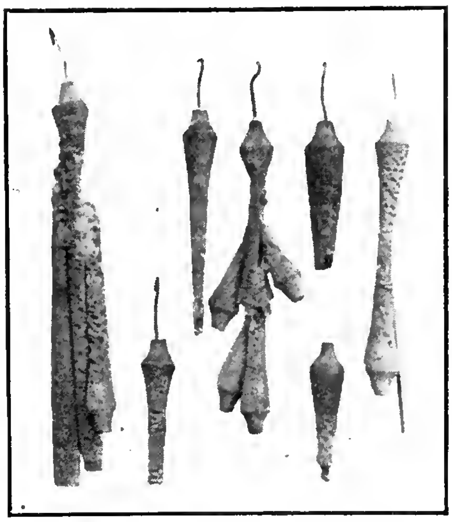
Neither copper carbonate nor copper cyanide as a single factor must be taken then as a basis of calculating their relative costs in the plating solution, but when we take the solution complete, ready for operation, as a basis, there can be no doubt that with chemically pure materials the plater not only obtains a solution of maximum efficiency, but is able to materially reduce the plating costs. Once this fact is brought home, it will be a comparatively short time when chemically pure metal cyanides will entirely displace the materials of doubtful purity formerly used.

Standard Solution.

The fact that all copper salts in a cyanide solution must first be changed to a copper cyanide simplifies matters greatly, as copper cyanide can be added to any copper cyanide solution, no matter what salt was originally used to install the bath in question. The plater has obtained results with materials which were at his disposal, but it was always with a degree of uncertainty as to how the bath would behave. This uncertainty is entirely removed once a plating solution is standardized, and this ideal condition can only be reached with the use of metal salts which are correct from a theoretical and practical standpoint, and it cannot be disputed that the only metal salts which answer these purposes are the metal cyanides.

WELDING UP SCRAP NICKEL ANODES.

SOME important experiments in the welding of nickel anodes by the oxy-acetylene process have just been concluded in the plating department of The Prest-O-Lite Co., Inc., at its Indianapolis plant. As a result of these experiments and tests, worn nickel anodes which have previously been scrapped and sold at less than half-price are now being reclaimed at a saving of more than 100 per cent.



WELDED-UP SCRAP NICKEL ANODES.

The anodes used are castings of 90 per cent. nickel, 8 per cent. carbon and 2 per cent. iron. They are elliptical bars approximately 1½ in. by 3½ in. cross section, by 30 in. long, and weigh about 30 lbs. Their market value varies between 46c and 50c per lb. On the basis of the latter price, each 30 lb. anode has a value of $15.

By welding up old anodes which have been in the solution, and which have a junk value of between 22c and 25c per lb., this concern is now converting its entire pile of scrap nickel into what are practically new anodes at a total cost for gas and labor of less than 6 cents per lb. This estimate is based on a recent test at Indianapolis, in which 421 lbs. of scrap anodes were welded up at the following costs:

463 cu. ft. oxygen, at 2c.	$9.26
480 cu. ft. acetylene, at 2c. . . .	9.60
24 hours' labor, at 25c.	6.00
Total	$24.86

In view of the fact that this test was made before any experience in the operation had been gained, it is apparent that better results and greater savings are sure to be the result of practice. The method of handling this operation is about as follows:—

Operation Features.

As the anodes are eaten away by the solution, they are turned over to an oxy-acetylene welder, who "tacks" on scraps of old anodes by welding to increase the surface. One, two, three and sometimes four pieces of scrap are welded on, depending on the size and weight desired.

The welding flame is also employed to remove the brass hooks which are used to support the anodes while in solution. Under the intense heat of the oxy-acetylene flame (approximately 6,300° F.) the solder melts away rapidly, leaving a pure nickel bar, which is later welded up. Thus, by the addition of from, say, 5 to 15 lbs. or more of scrap nickel, a brand new anode, it is claimed, is manufactured at trifling cost, and every bit of scrap is utilized without the loss of a single pound of metal.

No flux is employed, as this has been found to be unnecessary. The pieces of scrap are simply melted-on or "fused" together, using another piece of nickel as a filling rod. The welding process is of great benefit in obtaining perfect fusion, which is essential, as all joints must have electrical conductivity equal to that of new anodes.

Another advantage is that no skill or experience in the art of oxy-acetylene welding is required to weld up scrap nickel anodes—in fact, any workman with average intelligence can do the work without previous knowledge of the process. The apparatus required to do the work is inexpensive.

Many previous attempts have been made to utilize scrap nickel anodes, the most common practice being to drill holes through several pieces and bind them together by means of lead rivets. This method depends upon the contact of the wire or rivet and the piece of scrap to conduct the current, and is, therefore, of uncertain value, and in many cases a flat failure.

PRODUCTION METHODS AND DEVICES

A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

JOBBING PULLEY PRACTICE.

By J. H. Eastham.

WHILE ordinary pulley moulding is so simple as to call for no special explanation, circumstances occasionally arise in millwright and repair shops that require a little study in order to keep cost of production low enough to cope with competitive selling prices. The foundryman owning a set of pulley patterns of loose rim, separate hub and arm types possesses a

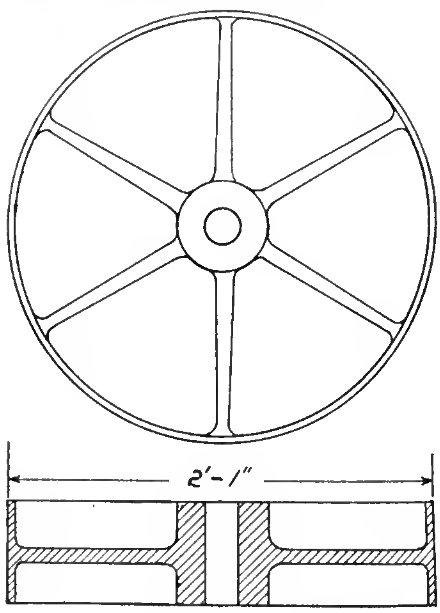


FIG. 1. PULLEY TO BE MOLDED.

valuable asset if he be located in a manufacturing centre, as he is then able to handle rush orders to customer's satisfaction.

The casting 2 ft. 1 in. diameter by 6 in. face, indicated in plan and sectional views of Fig. 1, was ordered to replace

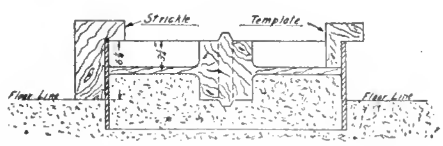


FIG. 2. JOBBING PULLEY PRACTICE.

a breakdown at short notice. The order was received at ten a.m., and was accompanied with the request that the finished pulley be shipped not later than the evening of the following day. The pattern, nearest to size of casting required, measured 2 ft. 4⅝ in. outside diameter, by 10 in. deep, and was used regularly for the production of 24 in. diameter pulleys. The method of molding employed was as follows:—

The rim pattern was bedded into the foundry floor to a depth of four inches, dead level (a most important factor in large pulley moulding), the correct depth

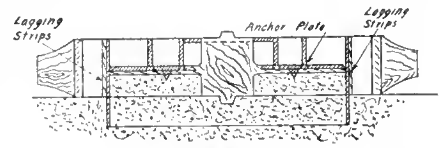


FIG. 3. JOBBING PULLEY PRACTICE.

being gauged by means of the strickle shown to left of sketch in Fig. 2. Following this operation, the inside of the rim was rammed up to within six inches of the upper edge, the arms and lower half of hub being next bedded to place correctly by using the small L shaped template shown to right of the same drawing.

A cheek or midpart approximately 2 ft. 8 in. square by 6¼ in. deep was now placed on the parting left by the strickle above mentioned, and an anchor plate used regularly for the production of 2 ft. 0 in. pulleys lowered on the parting between the arms. Lagging strips 6¼

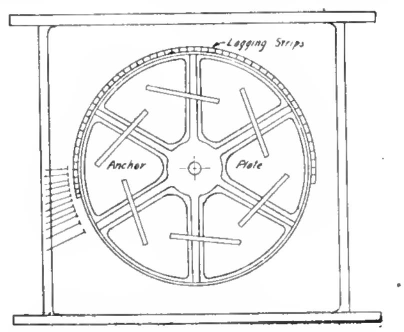


FIG. 4. JOBBING PULLEY PRACTICE.

in. deep by 1¼ in. wide and ½ in. thick were next placed around the outside circumference of the rim pattern to bring up to required diameter, plus contraction and machining allowances; the mould at this stage being shown in plan and cross section by Figs. 3 and 4 respectively.

The cheek and anchor plate were next rammed up to lip of rim in the ordinary way, the upper parting made, the cope rammed up, and guide stakes driven in

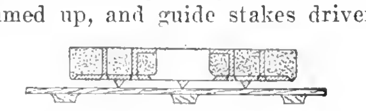


FIG. 5. ANCHOR PLATE ON BOARD.

handle corners. Following this the cope was lifted off and the rim pattern drawn.

The anchor plate with upper half of hub was next removed, the hub pattern drawn downwards, and the plate placed temporarily on a board as indicated at Fig. 5. The cheek was then lifted off, arms and lower half of hub drawn out and finished, and the lower four inches of rim filled in with sand to lower parting level. This operation is shown partly completed at Fig. 6.

The hub core was next placed in position, and the mould closed and made ready for pouring, being so shown in cross section at Fig. 7. With the object of removing surplus weight thrown on the rim owing to the increased diameter, as well as to secure perfect bal-

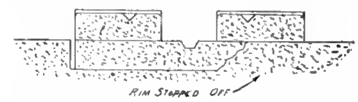


FIG. 6. JOBBING PULLEY PRACTICE.

ance, a cut was taken off the inside of the pulley whilst machining. The finished casting was delivered several hours ahead of schedule.

SAFETY FIRST — THE SHEET METAL PUNCH PRESS.

By J. H. Rodgers.

ONE of the greatest opportunities for the demonstration of "safety first" is in the protection of the operator on the ordinary sheet metal-working punch press.

A very large percentage of accidents to hands and fingers of men and boys in the metal working industries can be traced back to the stamping press, and in many cases when an accident happens, the operator will say that the press "repeated." This may or may not have

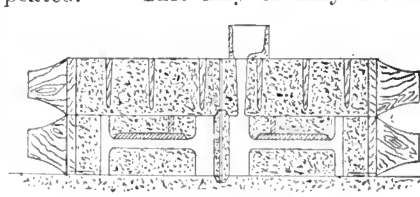


FIG. 7. FINISHED MOLD.

been the case, but, if the press did "repeat," it was due largely, if not entirely, to neglect on the part of the operator in not allowing the latch to engage the clutch pin and thereby release the press.

In the operation of most punch presses the foot is pressed down on a treadle, which pulls the stop latch away from the clutch pin. This clutch pin, by action of a spring, is forced in contact

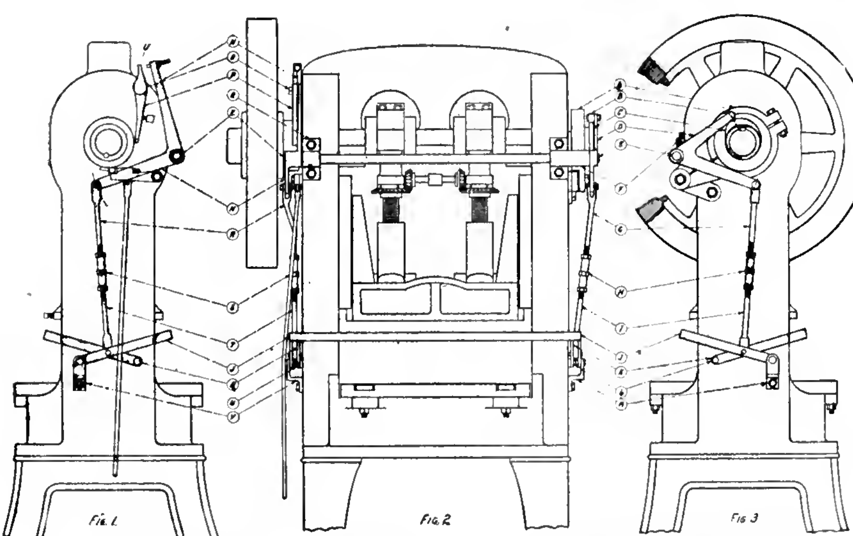
with the clutch which revolves the crank shaft. Removing the foot from the treadle, the latch returns to its former position and engages the clutch pin, thereby releasing the clutch when the shaft has made one revolution.

In many cases the operator, instead of removing his foot, will allow it to return to its former position with the treadle, and it is just at this point that the primary cause of many accidents becomes evident. Many operators, when keeping their foot upon the treadle, do not allow it to raise to its proper position, and instead of the latch engaging with the clutch pin the full amount, in a large number of instances, the contact is scarcely one-sixteenth of an inch.

Now this condition of affairs neither facilitates the operation of the press nor increases the output, while, on the other hand, an opening is left whereby any unforeseen incident, as his chair being jarred, a noise attracting his attention, etc., might cause the attendant to depress his foot before the proper time, and allow the press to operate or "repeat."

Many different styles of guards are now in service to reduce the possibility of accident, and these have had varying degrees of success. To produce a device that will protect (to the maximum) the operator in the performance of his duties, has been for years the desire of many an enterprising mechanic.

The object of this article is to place before the readers of **Canadian Machinery** a safety device for power presses and analogous machines, which has been developed and patented by Wright & Stacey, of Hamilton, Ont., and is manufactured by The Brown, Boggs Co., of that city.

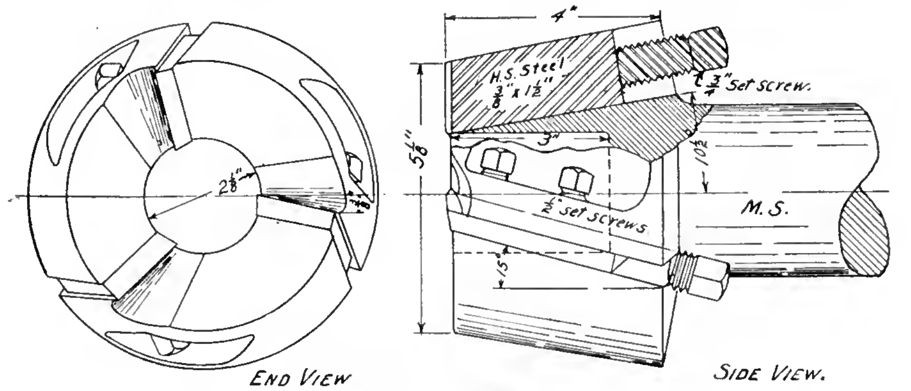


SAFETY DEVICE FOR POWER PRESSES AND ANALAGOUS MACHINES.

Safety Device Features.

The accompanying drawing shows the device applied to a double crank arch press, and protecting both the front and rear of the press. Fig. 1 shows a view from the clutch end of the press; Fig. 2, a rear view; and Fig. 3, a view from the brake end.

Secured to the brake end of the crank shaft is the cam C, which engages with the roller B carried on the upper arm of the bell crank D, which is secured to one end of the shaft E. Connected to the lower arm of the bell crank D are the rods G and I (adjustable with the right and left hand nut H). Rod I supports one end of the guard bars J and K.



A 2-INCH HOLLOW MILL.

Attached to the opposite end of shaft E is the bell crank N, which supports the other end of the guard bars J and K by means of the rods R and T and the adjusting nut S. The stud O carries the stop dog P, one end of which rests against the clutch hub of the press in such a position as to engage with the clutch pin when the crank shaft has moved through a portion of a revolution.

Operation.

The operation of the mechanism is as follows: The treadle of the press is lowered in the ordinary manner, allowing the ram to descend. Immediately the crank shaft—and also the cam C—revolve, the guard descends. If all is clear, the bars J and K will drop to their extreme position and allow the screw U to come in contact with the upper tail of the stop dog P, at the same time removing the opposite end sufficient to allow the press to complete one operation.

If, on the other hand, the operator's fingers, or hand, or any obstruction prevents the guard bars from reaching the safety position, the screw U does not reach the tail of the stop dog P. The opposite end will then engage with the clutch pin and disengage the clutch, stopping the press.

TWO-INCH HOLLOW MILL.

By "Nene."

THE distinguishing feature embodied in the accompanying sketch of a hollow mill is the angle at which the tools are set into the holder. This method gives greater clearance for the cuttings, causing them to curl outwards clear of the work. It also contributes to the free cutting properties.

The body of the tool is of machine steel, the grooves being milled at the desired angle, and not quite equidistant to avoid chattering when in operation. The three inserted cutters are of high-speed steel.

Each cutter is held firmly in position by two ½-inch set-screws and is adjusted to position by the ¾-inch set-screw shown. The holes for these latter screws are drilled and tapped before the cutter slots are milled. The tool was designed for 2-in. work, but a limited adjustment above and below this size is obtained by retarding or advancing the cutters in the slots.

The satisfactory nature of the work done by this tool may be estimated by the fact that locomotive cross-heads and knuckle-pins have been reduced from a diameter of 4½ in. to 2 in. for a length of 1½ in., and threaded in the space of 2½ minutes.

BALL-BEARINGS FOR MILL LINE SHAFTING.

BALL-BEARINGS have now reached such a high level, both as regards design and manufacture, that the thoughtful works manager is asking the ques-

tion as to whether they can help him to overcome the very many troublesome bearing questions which confront him. The surest and safest answer is that given by the history and development of the ball-bearing industry, and is such that any doubt regarding their efficiency and reliability is soon dispelled. The idea of substituting the action of rolling for sliding is as old as anything we know of. The earliest application of this principle we find when heavy structures are moved by using pieces of tree trunk to act as rollers.

Owing to the specialization necessary for cheap production, the average engineer looks upon a ball-bearing as an unknown quantity, which is entirely due to the lack of information. The efficiency of a ball-bearing should not be less than 98 per cent. The co-efficient of friction of 0.0012 relative to the shaft diameter can be compared with the co-efficient of friction when surfaces rub against each other when under load. Should the co-efficient for the ball-bearing be higher than given above, an excessive amount of sliding instead of rolling is taking place, which owing to the smallness of the surfaces in contact would result in wear; therefore, sliding must be avoided. This is where the ball-bearing is superior when compared to the roller bearing, with which sliding always takes place, and thus gives a high co-efficient of friction when compared with a ball-bearing.

Ordinary Bearing Losses.

The efficiency of mill line-shafting on ordinary bearings is variously estimated by different authorities at between 60 to 70 per cent., the lowest value generally being favored. The loss of efficiency is due to the following causes:—

(a)—Power wasted due to sliding friction of the shafting.

(b)—Belt and rope losses, which easily become excessive when the speeds are high for the size of rope or belt adopted, and thus causing undue creeping.

(c)—Power wasted when the shaft is unduly out of line, and at every revolution a certain amount of power is taken in bending it.

Eliminating Friction Losses.

All these evils can be reduced by using ball-bearings.

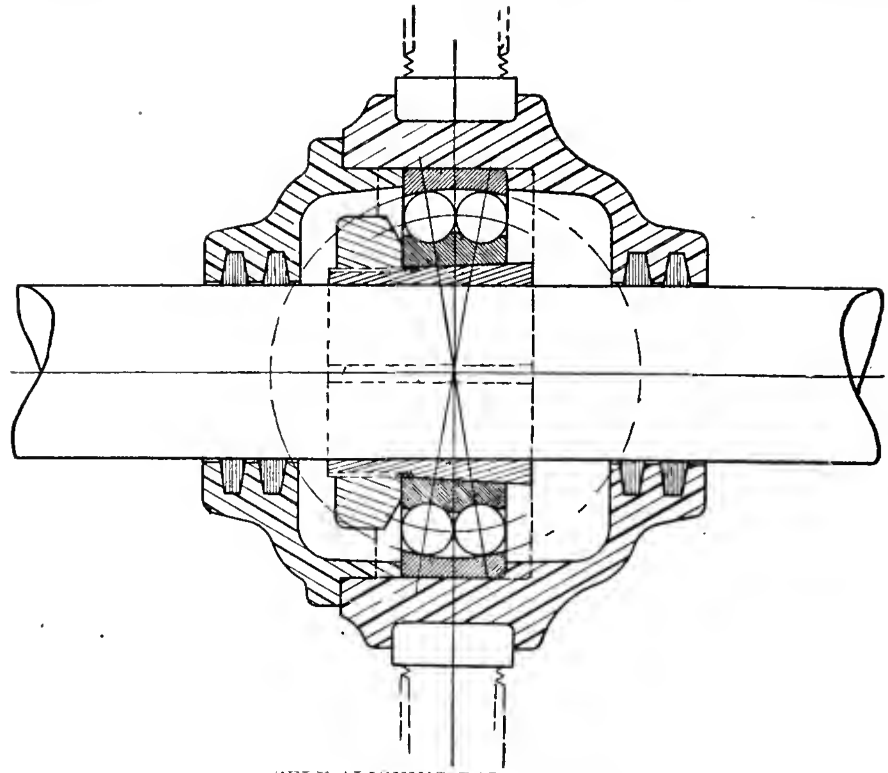
The loss due to friction for all practical purposes ceases to exist by substituting ball-bearings. The efficiency of the line-shaft due to this loss is raised at least 20 per cent., and since no energy is wasted at the bearings, the danger of them running hot is avoided.

Belt and rope losses are reduced by arranging the shafting to run at any speed required, and, mounting on ball-bearings, speeds of from 200 to 600 revs. per minute are not uncommon; the speed depending upon what is required and not upon the limit imposed by the bearings. When the shafting is run at a high speed upon ball-bearings the initial cost is reduced from 20 to 50 per cent. of that for a line-shafting upon plain bearings; this is brought about by using smaller pulleys and shafting for the same belt speed and pull. Besides the saving in power and the initial cost, the smaller dead weight supported by the columns is reduced.

The bending of the shafting can be entirely overcome by using wall brackets or hangers, which permit of easy adjustment. With the increased efficiency of line-shafting upon ball-bearings, a smaller power unit can be used for driving, so that a saving occurs both in the consumption of power and the capital outlay. A return of over 100 per cent. upon the capital outlay of the bearings is the rule; however, when the existing shartings is of larger diameter and has swells, and runs at a comparatively slow speed, the figure is reduced, but it is very seldom below 40 per cent., even in the very worst cases. Ball-bearings only require their housings to be filled with a suitable lubricant two or three times per annum.

Shafting upon ball-bearings is free from wear, which cannot be said of shafting running upon plain bearings, and when the atmosphere is of a gritty nature this wear becomes serious.

The illustration shows design of ball-bearing which has proved successful mounted in a cast-iron housing suitable for holding in a hanger frame. It is self-aligning, the alignment taking place by the frictionless rolling of the balls upon the spherical inner surface of the outer race of the bearing. The nut which forces the inner race of the bearing along the sleeve causing same to contract and grip the shaft, must be screwed up in the opposite direction to that of the rotation of the shaft. The diameter of the screwed plungers must be sufficiently large so as to prevent distortion of the housing. For each independent line of shafting one bearing only must be held sideways in the housing to keep the shaft in position as shown by full lines; all other bearings must be free to move sideways in the housings as shown by dotted lines.—The Power User.



SELF-ALIGNING BALL-BEARING.

Torpedo Balance Chamber. — The mechanism that determines the depth at which a torpedo runs is regulated first by a swinging pendulum and secondly by a valve kept in place by a spring, but which is forced in by the pressure of the water whenever the topedo sinks lower than a certain depth. The valve can be adjusted to any depth by the spring. Both pendulum and valve are connected to the horizontal rudders outside the torpedo.

Winnipeg, Man.—The contract for putting in the sub-structure for the huge cantilever bridge to be built over the Nelson river at Manitou rapids, for the Hudson Bay Railway has been awarded to Robert McDonald, of Winnipeg.

EDITORIAL CORRESPONDENCE

Embracing the Further Discussion of Previously Published Articles, Inquiries for General Information, Observations and Suggestions. Your Co-operation is Invited

CONCERNING SEMI-STEEL.

By "Melter."

MUCH has been said from time to time concerning the advantages and disadvantages to be derived from the addition of varying proportions of steel to cast iron, and melting in a cupola to produce commercial castings. Whether this can be done beneficially depends on local conditions involving size, shape and requirements of castings. The production of castings, soft or hard, irrespective of size or service conditions are also factors to be considered, although these ultimately resolve themselves into a question of cost. Generally speaking most castings require strength, so we shall consider this variety.

To appreciate why it is practical to use steel in the mixture or otherwise, something must be known of the factors influencing the strength of cast iron and the main differences effected by the use of steel. As the elastic limit is near the point of rupture in cast iron, it is necessary to get an iron having a high ultimate strength. That the elastic limit is near the ultimate strength is demonstrated by the fact that it is impossible to detect any difference other than that the deflection is proportionate to the load until just before failure.

The Strength Feature.

Strength depends on the size and percentage of graphite flakes, percentage of combined carbon, size of crystals of solid solution (iron, carbon, silicon), amount of oxide and impurities (sulphur, phosphorus, silicon and manganese).

Size of graphite depends on pouring temperature, rate of cooling, time iron has been molten before being poured, per centage of metalloids and total carbon. Graphite dissolves in the iron at temperatures below the melting point and therefore it is only the combined carbon on which the fusibility of cast iron depends. The fluidity is determined by the temperature of the metal, percentage of oxide, percentage of phosphorus and silicon, and the effect the metalloids have on the total carbon as well as the percentage of carbon.

Shrinkage.

Shrinkage is a great factor in using steel, and is dependent not only on the composition but on the size, shape, rate of cooling and whether the casting is made in dry or green sand. Anything that ultimately gives more combined carbon in the finished casting gives more shrinkage. If the iron be cooled quickly, the graphite carbon has not enough time to separate out, therefore the casting is hard and there is more contraction. Fluid contraction of course is quite another thing, as this is caused by bad design or in castings where one section solidifies before the other, the remaining fluid section having no molten iron to draw from its adjacent parts with a resultant cavity or shrink hole.

If, by the use of steel, the total carbon content is lowered, fluid contraction is increased. Fluid contraction can be overcome by the judicious use of chills, gates and risers. Shrinkage is not always uniform, in fact high total carbon, or low total carbon with high graphitic carbon expand before shrinkage, which expansion is due to the separation of graphite. During subsequent shrinkage there may be periods when expansion takes place due to the solidification of phosphide entectic (Steadite), and another expansion may take place when the iron changes from the alpha to the gamma state which would be about 1,300 degs. Fah. By actual measurement a few curves have been made relative to the amount of first expansion and total shrinkage, the results being tabulated as follows:—

% steel	% scrap	Si.	Mn.	S.	P.	CC.	GC.	TC.	Relative Expansion	Contraction	Chill	T/S sq. ins.
0	92	2.18	.54	.162	.691	.94	2.41	3.35	1½	28	1-16	22,800
7	77	.68	.50	.12	.391	1.00	2.60	3.60	0	36	1-16	31,200
20	50	1.50	.60	.134	.474	.80	2.70	3.50	2	26	¼	27,000
25	50	2.26	.60	.104	.526	.80	2.46	3.26	1½	28	⅜	....
30	50	1.48	.59	.14	.415	.99	2.85	3.84	4	27	⅜	32,700
30	50	1.30	.55	.127	.454	.76	2.19	2.95	3½	22	¼	32,800

From my observations it was noted that the expansion depends on the graphitic carbon and the contraction on the amount of combined carbon irrespective of the quantity of steel in the mixture. I have obtained the same physical results with the air furnace, and with cupola melting without using steel, simply employing varied proportions and compositions of scrap.

Quantity of Steel.

The quantity of steel used depends on the section of the casting and whether machining be necessary or not. If the casting have light and heavy sections it is not easy to select an iron which will run well and be free from spongy spots, etc. Steel in cast iron is said to give greater strength which is true if the composition is arranged accordingly but where fluid hot iron and small sectioned castings are the requisite, the silicon and phosphorous has to be increased to such an extent that the strength is reduced correspondingly. We know silicon and phosphorus are detrimental to good castings as regards their strength, machining qualities and softness, therefore a happy medium in the percentage of steel added for light castings must be found. In very heavy work semi-steel is economical, as it gives a uniform fracture which it is not possible to get with ordinary cupola iron mixtures; the ultimate strength is also high.

For hydraulic work, machine bed ways or places where wear is a factor, when superheated steam is in contact with fittings, for grate bars and furnace parts, semi-steel, when used in the right chemical proportion, is efficient. The table gives suggested analyses and proportions of steel in various mixtures.

Service.	Si.	M.	S.	P.	% Steel
Loco. cylinders and piston rings	1.0 to 1.3	.8	.06	.50	20
Corliss engine cylinders	1.6	.85	.06	.72	20
Automobile cylinders	2–2.25	.75	.07	.40	12½
Hydraulic press beds	1.6	.80	.06	.5	30
Grate bars and heat resisting castings.....	2.0	.80	.07	.30	40
Auto. piston rings	1.8	.35	.08	1.0	10
Auto. castings (fairly heavy)	1.8	.80	.07	.40	20

CALCULATION OF SHAFTING.

By J. A. Adie.

IN the design of machinery, one of the most difficult questions to decide is the minimum size of the shafts to be used to perform a given amount of work. This question is generally one of the first which must be solved, approximately at least, owing to its influence on the shape and size of the other component parts of the design. If our shafts are larger than need be, it often means, beside the waste of material, that a larger pinion, for example, must be used, so that we may have sufficient metal below the roots of the teeth. This for a given ratio of gearing would increase the distance between centres of gears and consequently necessitate a larger and correspondingly cost-

ly frame or housing. It can be readily seen that, as a larger shaft also requires a longer and heavier bearing, the cost of manufacturing is intimately connected with the sizes of shafting used.

The Starting Point.

As the problem usually presents itself, we are given either the belt-pull or tooth-load of the pulley or gear mounted on the shaft, or a very common form is to know the horse-power to be transmitted and the r.p.m. which the shaft makes. In either case, the first thing we must discover is the torsional moment or twist on the shaft in inch-pounds, and we must also find the direct load supported by the shaft considered as a beam. The torsion in the first case will, of course, be the belt pull or tooth load multiplied by the radius of the pulley or gear in inches. In the second case, the twisting moment T may be found by the formula

$$T = \frac{63025 \times \text{h.p.}}{\text{r.p.m.}}$$

If we had only to consider torsion, the question of shaft sizes would be very simple, but this is hardly ever the case, as there is nearly always a load causing a bending movement in the shaft, in addition to the force tending to make it rotate. The torsion is always caused by some force applied at the end of a lever-arm or at the rim of a wheel or gear, this force tending to bend the shaft. If the lever or wheel be placed on the shaft midway between two bearings, the bending moment B will be $\frac{WL}{4}$ where W = force in pounds and L = length between supports in inches, or if placed outside a bearing as in case of an overhung gear, B = WL.

Determining the Total Stresses.

Now, to arrive at an idea of the total stresses in the shaft, we must combine the bending and twisting moments and obtain what is called the equivalent moment. As the bending moment acts at right angles to the twisting moment, it can be seen that the equivalent moment is somewhat as the hypotenuse of a right-angle triangle, or $\sqrt{(B^2+T^2)}$. The formula as given by different authorities varies somewhat. Rankine gives the equivalent bending moment as

$$\tfrac{1}{2}B + \tfrac{1}{2}\sqrt{(B^2+T^2)}.$$

A shaft will stand twice the strain in bending that it will in torsion, as the axial moment of inertia $\frac{Pd^2}{16}$ is twice the polar moment of inertia $\frac{Pd^2}{32}$. Thus the preceding formula may be written $B+\sqrt{(B^2+T^2)}$ = equivalent twisting moment.

Reauleaux gives the value $\tfrac{3}{8}B + \tfrac{5}{8}\sqrt{(B^2+T^2)}$ = equivalent bending moment, while another formula which has been used very successfully makes equivalent bending moment $= \sqrt{(B^2+.5T^2)}$.

Having found the equivalent twisting moment Rr, we may arrive at the diameter (d) of the shaft required from the formula

$$d^3 = \frac{16Rr}{PS} = \frac{5.1Rr}{S},$$

S being the allowable stress per square inch in the shaft, a safe figure to use for ordinary mild steel shafting being 8,000 lbs. per sq. inch. If we find the equivalent bending moment, Bm, the formula becomes $d^3 = \frac{32Bm}{PS} = \frac{10.2Bm}{S}$, using the same value for S as before.

Other Considerations Affecting Diameter.

Now, while a shaft chosen may be of ample size to safely bear all the strains that may come upon it, we may find it necessary to increase the size on other considerations. A long shaft has a tendency to twist through a certain angle at one end, relatively to the other end; it should therefore be examined as to this angle of torsion at maximum load. The angle of torsion in degrees will be $\frac{583.6Rrl}{d^4G}$, Rr being the twisting moment. l the length in inches and G the torsional coefficient of elasticity = 12,000,000 for steel shafts. The allowable angle of torsion should not exceed .75 degree per ten-foot length of shaft

A shaft should also be examined for deflection or springing between supports, which might be sufficient to throw a pair of gears out of correct mesh, or in case of a shaft transmitting motion by means of levers, would cause considerable lost motion. The deflection can be ascertained by the common formula for beams of circular section and should be limited to 1/300 of the span between supports.

Deflection Example.

Supposing that we require a shaft to transmit 50 h.p. at 150 r.p.m. and driven by a 36-in. gear placed immediately outside the shaft bearing. The turning moment will be $\frac{63025\ \text{h.p.}}{\text{r.p.m.}} = \frac{63025 \times 50}{150} =$ 21,008 inch lbs.

The tooth load on the gear is $\frac{21{,}008}{18}$ = 1,169 lbs. Taking the distance from the centre of the gear to a point of support somewhat inside the end of the bearing as 5 in., then the bending moment will be 1169 × 5 = 5845 inch lbs. The equivalent twisting moment will be $5845+\sqrt{(5845^2+21008^2)}$ = 27,645 inch lbs., then $d = \sqrt[3]{\left(\frac{5.1 \times 27645}{8000}\right)} = 2.6$ in., the size of shaft selected being $2\tfrac{3}{4}$ ins. According to Reauleaux's formula, the equivalent bending moment is $\tfrac{3}{8} \times 5845 + \tfrac{5}{8}\sqrt{(5845^2+21008^2)}$ = 15,800 inch lbs., then $M = S\frac{I}{C}$ or $15{,}800 = \frac{Pd^3}{32}$, whence d = 2.71 ins., or $2\tfrac{3}{4}$ ins., practically the same result as before. M = bending moment, S = stress per sq. inch, $\frac{I}{C}$ = section modulus of shaft.

Using the third formula mentioned, $\sqrt{B(B^2+.5T^2)}$, equivalent bending moment $= \sqrt{(5845^2+.5 \times 21008^2)}$ = 15,963 in. lbs., and $15{,}963 = 8{,}000\frac{Pd^3}{32}$, whence d = 2.73 ins., being about the same as in the two former cases.

Since the gear in this instance is located close to the bearing, we may omit to examine this shaft for deflection. Supposing, however, this shaft to be 8 ft. long, the angle of torsion will be

$$\frac{583.6 \times 21008 \times 8 \times 12}{2.75^4 \times 12{,}000{,}000}$$

= 1.72° which is below our limit of .75° per foot of length. The foregoing methods relate to revolving shafts only.

There is also a class of shafts in which the motion is oscillating and the angle of movement small, as for example shafts carrying brake levers, operating levers, etc. These shafts may transmit heavy torsional and bending moments, but on account of the small angle of motion, it will be sufficient to calculate them for bending only. The deflection and angle of torsion is especially important in this case and should be carefully ascertained, as a small amount of loss motion will reduce the effectiveness of a brake lever very seriously.

CONCERNING BELT SLIPPAGE

By N. G. Near

WITH reference to R. McLaren's recent contribution "Concerning Belt Slippage," it was I who wrote the article to which he refers in "Woodworker." I will therefore endeavor to

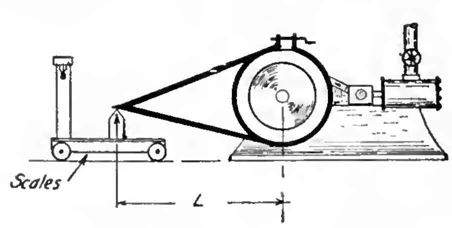


FIG. 1. CONCERNING BELT SLIPPAGE.

explain more clearly why each per cent of belt slippage costs one per cent of

the coal pile, or, as stated in the article, why a slippage of 5.2 per cent. will waste 5.2 per cent of the coal pile.

I will use the example Mr. McLaren cites—a hoisting engine—as it is an ideal one to use. This engine, sketched in the figure herewith, is so arranged that it will raise a weight of 33,000 pounds one foot high in one minute, which is equivalent to doing the work of one horse power. Now, when there is no slip in the "clutch ring" which I have shown, all of the mechanical energy delivered by the engine will be expended in lifting the weight. However, on giving the matter thought, it will be clear to any reader that Mr. McLaren is wrong when he says—"If the clutch be applied to slip so that the weight is raised ½ ft. in one minute, only ½ horse power of work will be performed, and about half as much coal will be used, instead of half the coal being wasted as 'woodworker' claims."

I will explain it in this way:—Let us assume that the 33,000 pounds weight does not move upward at all, while the engine is running at normal speed. The weight is hanging there and is certainly exerting a tension of 33,000 pounds through the cable. It is being held there by the "friction" of the clutch ring. If there were no friction the weight would fall. Therefore, the engine is doing work even though the weight does not move a millionth of an inch. In fact, the engine is doing just as much work as it would be doing if the weight were moving upward at the rate of one foot per minute. This is true for the same reason that in a Prony brake, Fig. 2, the power of an engine is determined by measuring the pressure P on the scales, multiplying it by the "theoretical" distance through which it moves in one minute (which is 2LTTN) and dividing by 33,000. The brake and scales do not move at all, yet. power is being developed.

In the case of the hoisting engine and the 33,000 pound weight, the case is identical. In fact, many Prony brakes are designed on that very principle, i. e. with suspended weights. The behavior of the engine—cut off, etc., is just the same when the suspended weight is not moving as when it is. The only way in which the power could be reduced with a weight moving more slowly would be to "gear down" the speed of the cable; then, the horse power delivered by the engine would be directly proportional to the speed at which the weight is being raised, neglecting transmission friction through gearing, and assuming that there would be no slip in the clutch.

The same is true with belts. If we had a belt that did not move at all, but in which the tensions were the same as when pulling full load, the engine would be dissipating energy at the same rate at which it is spent when pulling full load. We would then have a belt-Prony-brake. Where belt slip is 50 per cent, one half of the fuel is wasted, and where there is no belt slip, no fuel is wasted on that account, but it is always directly proportional to the slip except in cases where tensions change while slip takes place. Usually, though, where slip is 5 per cent or thereabouts there is very little change in belt tension, if any.

For these reasons, in gasoline engine belts, where speed fluctuations are often rather violent, the slip occurs at the time when tensions are greatest and therefore each per cent of slip represents more than one per cent of fuel loss.

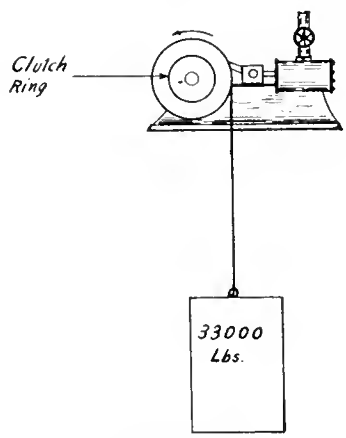


FIG. 2. CONCERNING BELT SLIPPAGE.

A slipping belt is therefore expensive, not only in the cost of the wearing out of the belt, but in the cost of the wasted fuel.

Stimulating Effort.

By J. T.

IT is easy for anyone to criticize; there are, therefore, more critics than boosters. A friendly or kindly word of commendation has often proved the incentive for a worker to go on and do better, it being human nature to esteem admiration and encouragement from one's fellow-man.

A few words of praise may cause a certain type of man to stop his forward march, his reasoning being somewhat as follows: If the boss thinks I am "it," I guess, as things are, I am good enough for keeps. This class of man will never amount to much in the engineering game, and unless he is driven along by harsh words he will not do an honest day's work. In his hours of freedom he will generally be found around bars or poolrooms, or some other equally-to-be-avoided resorts, and no amount of boosting would do him any good. It is a pleasure to know that this kind of man is not very numerous among machine shop operators.

Even if they do not receive any boosting from "the boss," mechanics can depend upon their trade journal for a certain amount of encouragement. I know of more than one man who had the blues and got rid of them by taking his troubles (by mail) to the editor of his engineering paper. The operator will always be sure of getting a number one brand of good advice and some "straight-from-the-shoulder" words of encouragement in addition.

At the present time, when all classes of publications are commenting upon the high cost of living, the engineer is forced to consider success not only from the standpoint of doing his duty in manner that leaves nothing to be desired by his employer, but he must also consider the "cash received for services rendered" side of the question. He may be a perfect success in a small plant, and be absolutely certain that he lacks the skill and experience to handle a better paying situation offered to him, but the fact that his wife and children have insufficient food and proper clothes may tempt him to take the position.

It is difficult to give advice off-hand in a case of this kind, for many men have taken positions above their class. They have done so, however, with a determination to make good and in many cases they have won out. It is nevertheless a dangerous game to play in engineering. Ambition is a fine thing, while grit and common "horse sense" are better, yet absolute necessity has made more "top notchers" than both combined.

The man who shirks his work because he is overworked, underpaid, and never "boosted" has not enough "horse sense" to make a success of himself anywhere, much less in an engine-room. To become a "top notcher," an engineer must never be satisfied that further improvement is impossible, either in his ability or in the equipment under his charge. He must be continually upon the alert to improve conditions, to decrease operating costs, and with these ends in view he may not discontinue his technical journal and engineering book studies.

MOTOR THROWING OIL.

By E. C. Parham.

THE tendency of motor bearings to throw oil, that is eventually drawn into the motor to saturate its windings, may be due to a hot bearing, or to a defective bearing, or to excessive and careless application of oil, or to the overflow pipe being stopped up, or to a pumping action that may become effective as the result of excessive lining wear. In most cases, however, excessive and careless oiling is responsible.

Except where information is furnished

as to the amount of oil required to refill a bearing, or to renew normal loss, it is the better plan to apply the oil through the overflow pipe. By carefully noting the level of the oil in this pipe, while slowly pouring it in, a reliable indication of the oil level in the bearing becomes available. Most caretakers resort to the quicker method of applying the oil through the top opening of the bearing. The objections to this method are that, unless the oiler is careful, he will spill oil outside, or if he is careful, but continues to pour oil in until he sees a little run out of the overflow pipe, the overflow will continue for some time after the oiler leaves, since a certain amount of time is required for the oil to work its way down from above, and up through the overflow pipe.

An inspector was asked to prescribe for an elevator motor that was "throwing oil." The motor windings, brushes, brush rigging, slip-rings, floor and elevator platform were saturated and wherever oil could stand in pools it did. If the motor had been engaged in pumping oil, it could hardly have made a better showing. The inspector cleaned everything concerned with the motor, flushed out the bearings with gasoline, refilled the bearings through the overflow pipe until the oil came up to within $\frac{1}{4}$ inch of the top of the overflow, and then had a heart-to-heart talk with the oiler—which produced satisfactory results.—General Electric Review.

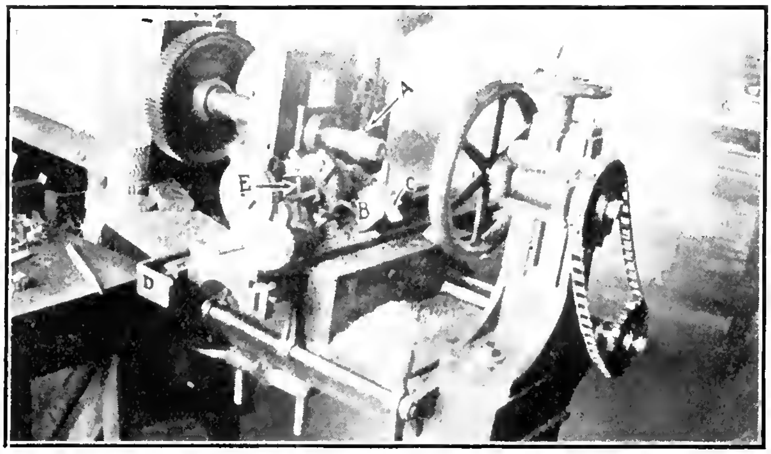
FIXTURES FOR MILLING TOOTHED WHEELS.

By D. A. Hampson.

FIVE thousand specially toothed wheels were required for a new device. These wheels were to have twenty-four teeth, $\frac{1}{8}$ inch high, of $\frac{1}{8}$ inch radius, equally spaced about the circumference. The blanks for the wheels were punched from cold rolled steel 3-16 inch thick and a hole .430 inch diameter was also punched in the centre and finished to 7-16 inch with a reamer. It was required to cut the teeth concentric with this hole within a limit of 0.0015 inch smaller or larger, the diameter being given as 3 inches.

The part of the work to be considered will be the cutting of the teeth and the tools used for the same. Naturally, a low cost for the job was desired; no more of the wheels would ever be wanted and so any special fixtures would have to be thrown away after the completion of the work.

A Lincoln miller in first-class condition was elected for the job and a "stub" arbor of the shortest length that could be used was made up. A pair of B. & S. high-speed formed cutters were purchased—the cutters of a form that finished three teeth at one passage—therefore eight indexings per revolution of the wheels finished one set. The cutter is shown at A in position on the arbor.



FIXTURE FOR MILLING TOOTHED WHEELS.

The headstock from a set of plain index centres was stripped of the worm shaft and the live "centre." In place of these, a tool-steel, hardened arbor was supplied, the arbor carrying a flange $2\frac{3}{4}$ in. diameter, which was bolted to the dogplate of the head. Four wheels were clamped on the arbor at one time. At the tailstock end the arbor was threaded for a large thumb-nut, drilled with a $\frac{3}{8}$ inch drill for tapping, and beyond the threads was turned $\frac{3}{8}$ by 1 inch to go in a hardened bushing in the tailstock. This provided substantial support for the work at the tail end and though the nuts with the shallow thread gave out, the hardened arbor showed no signs of wear. A washer of the ball and socket type between the nut and the wheels prevented any bending of the arbor which might have occurred had any of the wheels been slightly warped.

Before doing the work it was assumed that to try to cut more than four wheels at a time would delay the work, the time involved in loading and unloading the close-fitting pieces, cleaning of chips, and the spring of a longer arbor all being considered. The actual work proved this assumption to be well founded.

Indexing was simplified by having only eight holes to "catch" with the index pin; the other holes on the circle were plugged so that no mistake could be made. A special index pin, E, was made having a long cross bar for easy working and an extension at one end over which a spring was slipped. Then to index from one hole to the next, the operator took hold directly on the worm gear with one hand and as the pin was released with the other hand gave the gear a turn until the pin dropped of itself into the next hole. The pin and spring may be seen in the photo.

A special tail-stock is shown at B. It is a casting fitted with a slide into which is pressed the bushing for supporting the arbor. The slide is clamped by a single nut to which the wrench C is fited, so that it will not come off. Releasing the nut and moving the slide back gives ample room for loading the work with ease and comfort—the tail-stock is made U-shaped to give plenty of clearance around the wheels. The slide joins the U together at the top; a pin prevents the slide from being shoved out too far.

So that no time would be wasted on unnecessary movement, an L-shaped stop, marked D, was made for the table to stop against in the nearest safe distance from the cutter when loading and unloading. The movement for cutting the teeth was such as to just clear the cutter when the wheels were turned and was controlled by a hinged block inside of the "L"—hinged so that it could be swung out of the way when loading (in the photo it is thus, and cannot be seen). Every inch which any operator might unthinkingly move was saved and controlled by parts heavy enough to withstand abuse. Not a single loose piece, excepting one thumb nut and washer, had to be handled.

The hand reverse feed was altered as shown so that the operator could do all his work while seated without moving. A link belt and two sprockets—both in stock—carried the feed to the back shift. One sprocket and the hand-wheel are keyed to a short shaft turning in a sleeve in the tail-stock clamp. A guard, not shown, was provided for the chain.

In service, the whole arrangement was found as nearly ideal as any, not automatic, could be and no changes from the original plan were made. An average of 140 wheels per day of ten hours was turned out, all within the required limits of accuracy and finish. One of the wheels is shown against the headstock and a pile of them are to the left. The cutters milled an average of 600 wheels between sharpenings. Seated, with a bench at his side, the operator had time to remove the burrs between the cuts.

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

ENGINE LATHES WITH ATTACHMENTS FOR SHELL WORK.

THE standard engine lathe can be rendered more efficient on shell work when equipped with certain special attachments. These latter can, of course, be readily removed at any time and standard parts applied, thus rendering the machine ready for its regular work. The Niles-Bement-Pond Co. are furnishing lathes equipped with several types of attachments which adapt them to high production of duplicate work in the finishing of shrapnel and different sizes of high explosive shells, both of the solid and hollow-forged types.

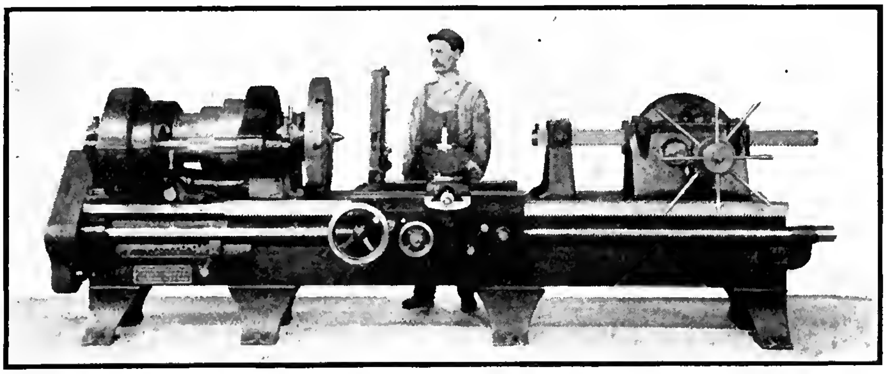


FIG. 1—FRONT VIEW OF 26-IN. DOUBLE BACK-GEARED ENGINE LATHE EQUIPPED FOR BORING HIGH EXPLOSIVE SHELLS.

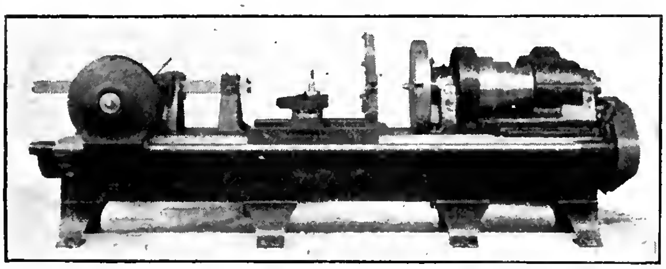


FIG. 2—REAR VIEW OF 26-IN. DOUBLE BACK-GEARED ENGINE LATHE FOR BORING HIGH EXPLOSIVE SHELLS.

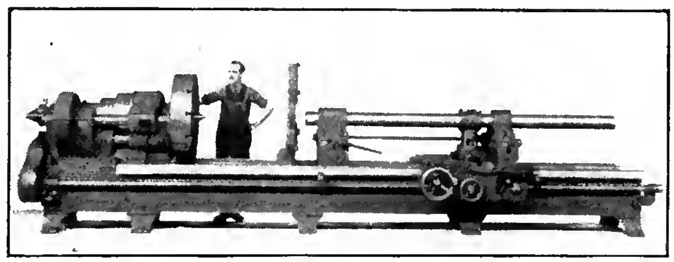


FIG. 3—SHOWING A 36-IN. TRIPLE-GEARED ENGINE LATHE EQUIPPED FOR STRAIGHT OR TAPER BORING OF SHELLS.

Boring Tailstock.

Figs. 1 and 2 show front and rear views respectively of a 26-in. double back-geared engine lathe, equipped with a boring tailstock for boring high explosive shells of either the solid or hollow forged type. With the exception of the tailstock, the lathe is the standard type of latest design with improved features. The boring tailstock and support can be readily removed and a standard tailstock applied for regular work. The interior contour of the shell is obtained by the use of bottoming and forming tools built to suit the requirements of each case.

The tailstock is fitted with a square forged steel boring ram, the latter having power feed by means of a shaft geared to the driving works and running along the rear of the bed. The shaft drives through worm and worm wheel to the pinion and rack on the ram, this giving a smooth, positive motion. Large pilot wheels are provided for hand traverse of the ram and for starting and stopping the feed. The lathe is equipped with quick-change gear feed mechanism. To prevent vibration of tools, the boring ram is provided with a support, which can be adjusted along the bed to a position near the work. A standard tool carriage for turning operations forms part of the equipment, a steady rest being also furnished for supporting either a pot chuck or the shell itself as the case may be.

Attachment for Straight or Taper Boring.

Fig. 3 shows a 36-in. triple-geared engine lathe equipped with a boring bar, mounted on the carriage, and arranged for either straight or taper boring of shells. The boring bar is carried in a bearing with a swiveling base mounted in the carriage. Two supports are provided for the bar, one on either side of the carriage. These supports consist of a bearing for the bar mounted on a slide, which has cross adjustment on a substantial base. For taper boring, the support near the shell is shifted to one side of its central position and the other end support shifted to the other side of its central position. The support bearings have means of swiveling a sufficient amount. The central bearing

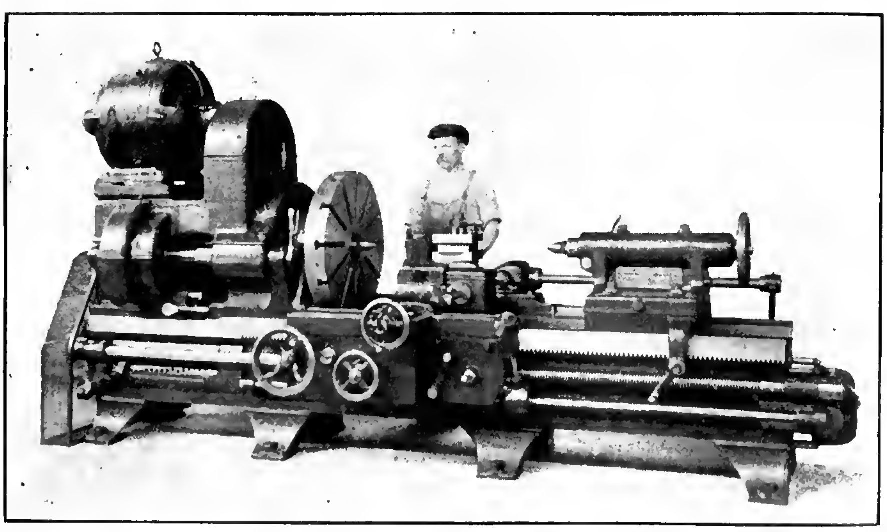


FIG. 4—SHOWING A 30-IN. DOUBLE BACK-GEARED ENGINE LATHE EQUIPPED FOR WAVING AND GROOVING COPPER BAND SEAT OF SHELLS.

of the bar is arranged to slide in and out on the carriage as the bar is fed.

The bar can be adjusted bodily across the lathe so that the cutter can be traversed inside the shell and fed into the work and at the same time always remain at a given set taper. This is accomplished by having the slides of the two end supports connected by screws and gearing so that they move simultaneously when adjusted by the ratchet wrench shown on the support nearest the headstock.

Attachment for Cutting Waves and Grooving Band Seats.

Fig. 4 shows a 30-in. double back-geared lathe of the latest design, equipped with an attachment for cutting the waves and grooving the copper band seats of shells.

The standard compound tool rest has been removed from the carriage and a special rest substituted. This consists of a lower slide, which is mounted directly in the carriage and has cross adjustment by a hand screw. Mounted on this lower slide is a tool slide. In order to obtain the wave effect, this tool slide is given a reciprocating motion parallel with the bed while the projectile revolves. This motion is obtained by means of an eccentric carried on a cross shaft which is journaled in the cross slide. The cross shaft is driven by bevel gears from a shaft located along the back of the lathe. This latter shaft is geared to the main spindle of the head, and suitable change gears are provided for obtaining the number of waves per revolution required on different sizes and types of shells. The eccentric is adjustable to produce the desired amount of the wave, and the depth of the wave rib is determined by the shape of the formed tool.

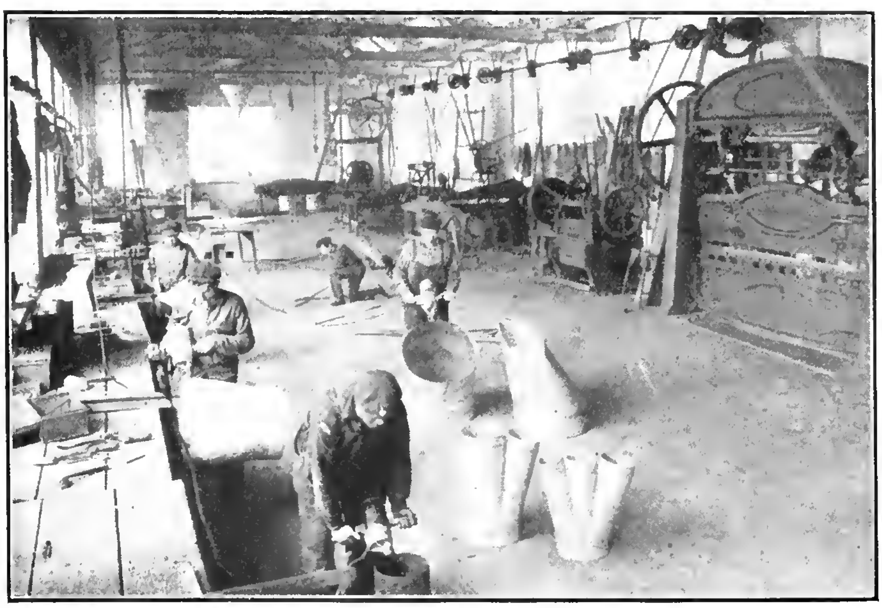
On lathes equipped with this attachment, it is customary to furnish also a four-sided turret tool post on the rear of the carriage. This permits all the operations on the band seat to be performed at one setting of the projectile in the lathe.

PORTABLE ELECTRIC DRILLS.

THE value of portable electric drills in the manufacturing plant is forcibly shown in the accompanying illustration, where electric drills, manufactured by The Standard Electric Tool Co., Cincinnati, Ohio, are being used. They are adapted to many classes of work, as will be noted. These drills are made in all sizes for both small and large work, the small tools having high speed and being very light in weight, which enables operators to drill holes in metal or wood with great rapidity.

Owing to the fact that a lamp socket connection is the only thing necessary to drive this equipment, the cost of installation is only that of the drills, no shafting or belting being necessary. The tools shown are of the universal type which operate on both alternating and direct current. They are employed on outside jobs, such as erecting, or where drilling has to be done. The feature of being interchangeable on either current gives them a very wide range of work.

On large metal sheets, drilling can be done right on the floor, and the difficulty of moving to a punch or drill press is eliminated. The principle of taking the tool to the work is very vividly illustrated here. In cases where the holes have been previously punched and do not match, the electric drill is used for reaming out.

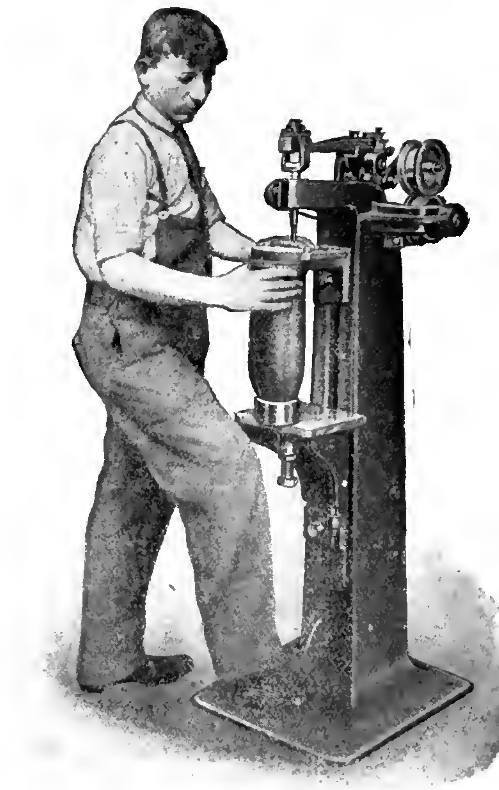


PORTABLE ELECTRIC DRILLS AT WORK.

The illustration shows holes for fittings and attachments to pipes and ventilator sections being produced by electric drills.

ROTARY VIBRATING RIVETING MACHINE.

THE rotary vibrating riveting machine made by the Grant Mfg. & Machine Co., of Bridgeport, Conn., has been especially fitted up to rivet over the base of the explosives projectile shown, in order to hold the gas plate securely in position.



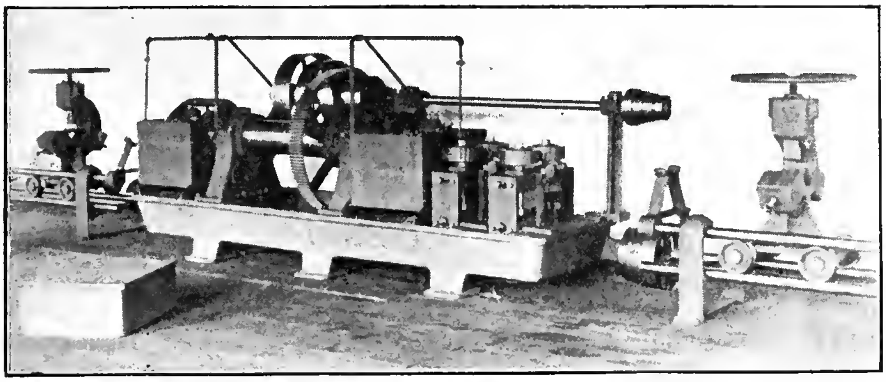
ROTARY VIBRATING RIVETING MACHINE

In order to prevent the possibility of the base of the shell being porous in the slightest degree, the end is recessed and threaded to receive a steel plate, the inner face of the latter being coated with a special cement before being screwed into place. The plate screws down below the back end of the shell sufficiently to allow the base of the shell to be peened or riveted over it, preventing the possibility of its coming loose.

The machine is fitted with a special ball-bearing revolving fixture which fits the nose of the shell before the plug is screwed into the nose, and the base of the shell is supported in a position which brings the vibrating hammer exactly over the joint where the base plug is screwed into the shell. The shell is rotated one complete revolution by hand, and, with the machine striking about 2,000 blows per minute, the plug can be riveted perfectly tight into the base in about ten seconds. With a change of fixtures, the machine can be adapted for 4.5 in., 18-pdr., or shells even larger than 4.5 in.

MACHINE FOR TURNING VANADIUM AND SPECIAL ALLOY STEEL SHELL BLANKS.

THE illustration and description refer to a product of the Brightman Mfg. Co., Columbus, Ohio, the purpose of which is the preparing or rough turning of vanadium or special alloy steel blanks, for conversion later on automatic machines into shrapnel or high explosive shells, the material when so treated being, it is claimed, perfectly round and true to size. With this machine it is possible to turn from 1,000 to 1,500 ft. of 2-in. round material in ten hours, and, taking this as a base, sizes 1 in. and up to 6 in. can be turned and finished in proportionate quantities.



MACHINE FOR TURNING VANADIUM AND SPECIAL ALLOY STEEL SHELL BLANKS.

The rough bar or rod is fed in at one end of the turning machine by a set of feed rolls driven by worm wheels and worms attached to perpendicular and horizontal shafts, a four-step cone regulating the feed. Material, after leaving the feed rolls, enters the roughing head, which reduces it very nearly to size. This head, as well as the finishing head, is composed of a steel cutter and guides set in the segmental slots, which have a screw adjustment. These heads are bolted to a cylinder having hollow bearings, through which material passes in the process of turning, and are driven by a gear and pinion. The latter is attached to a horizontal shaft, on which are different sizes of pulleys to give various speeds to the machine; or the latter can be motor driven. After leaving the roughing head, the material passes through the hollow cylinder into the finishing head, which turns it to size, and ready for the automatic machines.

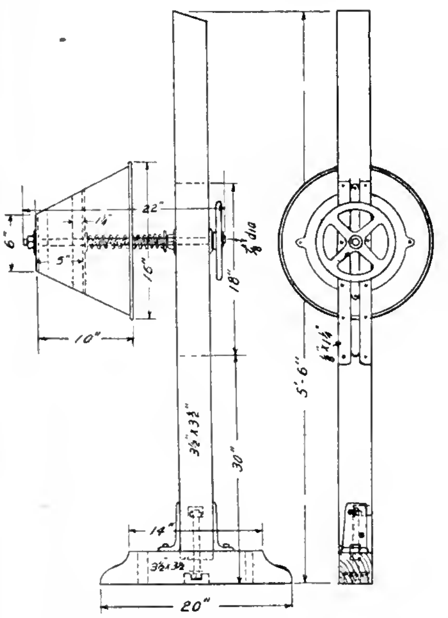


FIG. 2—DETAIL OF CENTRE FOR GALVANIZED PIPE WORK.

The bed of the machine is a receptacle for a soap solution, which is continually pumped on the cutters by a small pump on the rear. This drains back into the bed to be used again. Boxes surrounding the cutter heads are used for chips or turnings, and are so arranged with opening sides that they can be readily cleaned while the machine is in operation. At each end tracks are provided with a gripping device, which keeps material from revolving with the machine.

CENTRES FOR GALVANIZED PIPE WORKING.

By A. E. Granville.

A VERY convenient support for tin or galvanized iron pipe during the beading or crimping operation is shown by Fig. 1 and in detail by Fig. 2. Two of the supports are shown in position at A and B for work done on the machines, C and D. These centres may be raised or lowered to suit by means of the clamps E and F. The centre cones are made of heavy galvanized iron, and are backed by spiral springs, which keep the work pressed securely against the stops G and H on the machines, so that, when set, all the operator has to do is to throw in the clutch and watch the work revolve between the rolls.

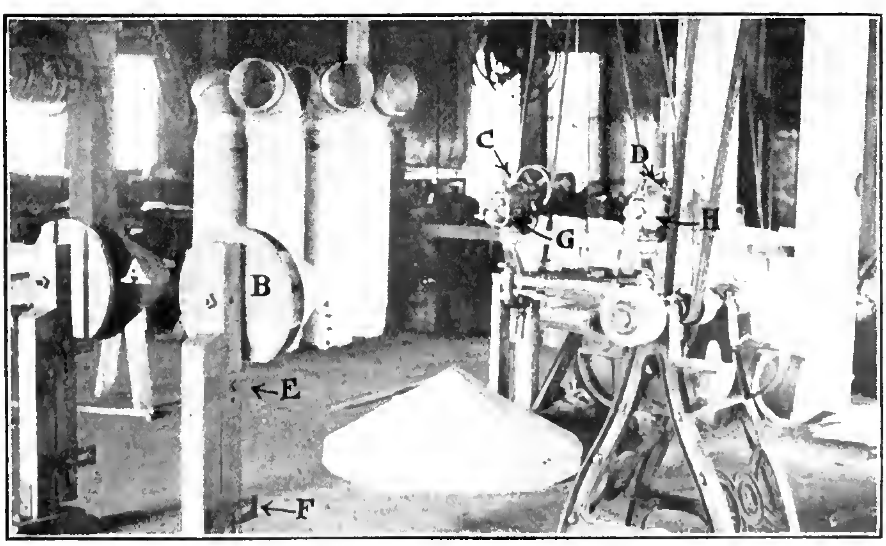


FIG. 1—CENTRE FOR GALVANIZED PIPE WORK.

HIGH RESISTANCE PYROMETER.

OUR illustration shows the high resistance pyrometer manufactured by the Brown Instrument Co., Philadelphia, Pa.

HIGH RESISTANCE PYROMETER.

This apparatus has a resistance of 200 ohms or more: it is therefore applicable to hardening, heat-treating and annealing furnaces where accuracy is a sine qua non. Originally pyrometers were all of the low-resistance type, and it has only been in recent years, we understand, that those of high resistance have become available.

THE COMING FOUNDRYMEN'S CONVENTION.

ACTIVE preparation is being made in every direction for the coming convention at Atlantic City, N.J., the American Foundrymen's Association and allied bodies, and there is little doubt that, when the week of September 27, 1915, arrives, everything will be in apple-pie order for this wide scope function.

The occasion will be marked by the annual meetings of the American Foundrymen's Association and the American Institute of Metals as well as the yearly exhibit of foundry supplies and equipment conducted under the auspices of the Foundry & Machine Exhibition Co. Heretofore, the Associated Foundry Foremen have held their meetings during this week, but since this organization has dissolved and its members have become affiliated as associates with the American Foundrymen's Association, they will take part in the deliberations of this society.

The program of the American Foundrymen's Association, while yet incomplete, has already assumed large proportions and to permit of full discussion of the many valuable papers that will be presented, two simultaneous sessions on malleable and steel castings will be held. The business meeting, which heretofore followed the close of the technical deliberations, will be held on Wednesday evening, Sept. 29, when the new officers will be elected and the business affairs of the association will be discussed.

A gratifying increase in membership has been recorded during the year, the enrollment now approximating 1,000, of which more than 150 are associates. The campaign for new members resulted in the addition of nearly 100 new names, and at the annual meeting it is believed a still further growth will be reported. Financially the society is in better condition than at any time in its history, and the balance in the treasury will permit of increasing the scope of the work that is now being carried on.

A partial list of papers that will be presented, follows:

"Resume of Advances in Foundry Practice," by Richard Moldenke.

"Application of Various Types of Molding Machines to Different Classes of Work," by I. J. Wilson and A. O. Backert.

"Time Studies on Molding Machines," by H. K. Hathaway, Philadelphia.

"Functions of Sand Binders," by H. M. Lane, Detroit.

"The Reclamation of Molding Sand," by W. M. Saunders and H. B. Hanley.

"Relation of the Foundry Foreman to the Manager," by S V. Blair.

"Manufacture and Constituents of Pig Iron and the Essentials in the Purchase of this Material," by O. J. Abell, Chicago.

"Pouring Systems for Gray Iron Shops," by H. Cole Estep.

"Fuel Oil Cupolas," by Bradley Stoughton, New York City.

"Thermal Reactions in Melting Gray Iron," by Dr. Joseph Richards, Lehigh, Pa.

"The Inspection of Automobile Castings," by C. B. Wilson, Pontiac, Mich.

"Defects in Gray Iron Castings and Remedies for Them," by Herbert Ramp, Cincinnati.

"The Value of the Vibratory Test in Steel Foundry Practice," by Lloyd Uhler, Pittsburgh.

"The Particular Application of the Converter in the Manufacture of Steel Castings," by C. S. Koch, McKeesport, Pa.

"Notes on Electric Furnace Construction and Operation in the Steel Foundry," by Mr. Gray, United States Steel Corporation, New York City.

"Correct Proportions and Essentials in Checker Design for Open Hearth Furnaces," by W. A. Janssen, Bettendorf, Ia.

"Causes for Shrinkage Cracks in Steel Castings," by William Bossinger, Marion, O.

In addition to the foregoing, reports will be presented by the committees on safety and sanitation, industrial education, costs, steel foundry standards, specifications for malleable castings, specifications for gray iron castings, specifications for steel castings, and specifications for foundry scrap.

Aside from the many attractions afforded by Atlantic City, the entertainment features will involve a theatre party and banquet, and a committee will be in charge of plant visitation, whose members will direct the visiting delegates to the many interesting foundries in Philadelphia and vicinity. It also is probable that numerous side trips will be arranged to enable visitors to inspect the shops in which they are interested, with the least amount of inconvenience.

Headquarters for the American Foundrymen's Association will be at the Marlborough-Blenheim Hotel. The meetings will be held on Young's Steel Pier, where the registration booth also will be located.

Foundry and Machine Exhibition.

C. E. Hoyt, secretary of the Foundry & Machine Exhibition Co., Lewis Institute, Chicago, reports that the space reservation already made, foreshadows one of the largest exhibitions ever held. Young's Steel Pier is admirably adapted for show purposes, and all facilities are provided for the rapid building and installation of machinery. The exhibition will be opened formally on Saturday, Sept. 25, and will close Friday, Oct. 1.

American Institute of Metals.

The headquarters of the American Institute of Metals will be at the Hotel Traymore, and the meetings will be held either there or on Young's Million Dollar Pier. The provisional programme is as follows:

D. H. Newland, Assistant State Geologist, New York—"Albany Sand."

A. D. Flinn, Board of Water Supply, New York—"Experience with Brass in Civil Engineering Work."

C. P. Karr, Bureau of Standards—"Molding Sand."

Charles Pack, Doehler Die Casting Company, New York—"Aluminum Die Casting Work."

Dr. Burgess and Dr. Merica, Bureau of Standards, Washington, D.C. — "Cracking of Wrought Brass from Overstrain."

William W. Clark, Seymour Manufacturing Company—"Manufacture and Use of Alumino-Vanadium."

C. V. Powell, British Aluminum Company, Toronto, Ont.—"Some Developments in Aluminum."

Russell R. Clarke, Pennsylvania Lines West—"The Advantage of a Standard Railroad Bearing Alloy (The Journal Bearing Shell, not the Lining)."

Dr. Weintraub, General Electric Company—"Silicon Resistance Furnaces for Melting Brass."

G. H. Clamer, The Ajax Metal Company—"Effect of Zinc on Copper, Tin and Lead Alloys."

W. M. Corse, The Titanium Alloy Manufacturing Company—"Copper-Aluminum Alloys."

Jesse L. Jones, Westinghouse Electric & Mfg. Company—"Forging Manganese Bronze."

S. L. Hoyt, University of Minnesota—"Amorphous State of Metals."

S. W. Parr, University of Illinois (Two Papers —"Method of Analysis for Complex Alloys," "Development of Acid Resistance Alloys."

Dr. Rawdon, Bureau of Standards, Washington—"Metallographical Examination of 88-10-2 Alloy."

F. A. J. FitzGerald, FitzGerald Laboratories—"Electric Furnaces for Brass Melting."

H. T. Kalmus, Kalmus, Comstock & Westcott, Inc.—"Cobalt in Non-Ferrous Metals."

Dr. S. Trood, U.S. Sherardizing Company—"The Electric Furnace for Sherardizing."

W. E. Barlow, Virginia Polytechnic Institute.

Thomas F. Wettstein, United Lead Company—"The Effect of the Present European War on the Metal Industries."

Elwood Haynes, Haynes Stellite Works—"Stellite."

Prof. D. J. Demarest, Ohio State University—"Analysis of Babbitt Metals."

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EMPIRE SERVICE PRIVILEGE AND OPPORTUNITY.

We have now got well past the inquiry stage as to who started this huge-scale war in Europe, the effects of which become more far-reaching all the time. Its finish is the all-important matter to-day, and this involves both men and munitions on a scale hitherto undreamed of. In the matter of manufacturing shells for the service of the Motherland, what we have already done may be taken as more or less of a preliminary effort only, because in no sense could it be said, except until recently, that our engineering and metal-working plants had mobilized their operative staffs and equipment on a war footing. This consummation has, however, materialized.

As in the matter of munitions' supply so has it been with the enlistment of our men for active service. True it is we promptly met the invitation to furnish both a first and second overseas service contingent, yet notwithstanding, it was but faintly realized, if at all, the nature of the task set our Empire and her Allies, and through them the desperateness of the mission and undertaking in which our fellows had embarked. Heavy casualty lists of more or less daily occurrence during the past few months have had an enlightening as well as a sobering and saddening effect, more especially as in spite of them all, the achievement has been in no wise such as to speedily bring an end to the conflict.

Speaking generally, we are much more alive to the call of Empire to-day than ever before, so much so that we are getting keenly enthusiastic about it. A growing-in-intensity response is being made by much of our manhood to the further invitation to enlist for overseas service. It has come home to us, that, no matter who started the war, we must needs bear a hand in finishing it, both thoroughly and expeditiously. The selfishness to which all of us are in some degree naturally addicted and have consciously or unconsciously cultivated still combats successfully the call for self-sacrifice, for such the call is.

No male in good health and without disability, and unmarried, between the ages of 18 and 30 years, is entitled to be classed as a man who does not in this crisis put his Country and Empire before every other consideration. The one and only immediate career of any real value to-day for our youths and young men is that of a soldier, and it goes without saying that the opportunity let slip now can never be redeemed. Let us get away, therefore, from the everywhere - prevalent, and instilled-in-our-individual-nature, idea that we are too important in some sphere of business activity to be spared, or that we are so highly educated or so richly endowed with this world's goods that it would be infra dig for us to take our place on the firing line and be a target for Germans to shoot at. As good, yes and better than the best, most gifted, and endowed of us, have stood in the trenches of Northern France and Belgium during the past twelve months, and have given their lives for a cause that not a few among us deem very much secondary to self.

There is a place to fill and a part to play in our Empire's cause by every citizen of our Dominion at this time, and none of us need long remain in ignorance of our relation thereto. If we are not actively aiding in the manufacture of munitions of war we should be making appreciable progress towards the trenches, and, if neither, then why not?

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey Forge, Pittsburgh	$13 20	$13 45
Lake Superior, charcoal, Chicago	.....	15 75
Ferro Nickel pig iron (Soo)	.....	25 00

	Montreal.	Toronto.
Middlesboro, No. 3	21 00	.....
Carron, special	22 00	.....
Carron, soft	22 00	.....
Cleveland, No. 3	21 00	.....
Clarence, No. 3	21 00	.....
Glengarnock	25 00	.....
Summerlee, No. 1	25 00	.....
Summerlee, No. 3	25 00	.....
Michigan charcoal iron	25 00	.....
Victoria, No. 1	21 00	19 00
Victoria, No. 2X	21 00	19 00
Victoria, No. 2 Plain	21 00	19 00
Hamilton, No. 1	20 00	19 00
Hamilton, No. 2	20 00	19 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	2.20
Steel bars, f.o.b., Toronto	2.20
Common bar iron, f.o.b., Montreal	2.20
Steel bars, f.o.b., Montreal	2.20
Bessemer rails, heavy, at mill	1,25
Steel bars, Pittsburgh	1.25
Twisted reinforcing bars	2.15
Tank plates, Pittsburgh	1.25
Beams and angles, Pittsburgh	1.25
Steel hoops, Pittsburgh	1.30
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.10
Small shapes	2.35
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ¼ to ½ in., 100 lb.	$2 35	$2 25
Heads, per 100 lb.	2 55	2 45
Tank plates, 3-16 in.	2 60	2 45

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$12 50	$12 50
Copper, crucible	14 50	14 50
Copper, unch-bled, heavy	14 00	14 00
Copper, wire, unch-bled	14 00	14 00
No. 1 machine, compos'n	11 50	12 50
No. 1 compos'n turnings	10 50	9 25
No. 1 wrought iron	6 00	6 00
Heavy melting steel	5 75	6 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings	12 00	12 00
No. 1 brass turnings	10 00	10 00
Heavy lead	4 50	5 00
Tea lead	$ 3 50	$ 3 75
Scrap zinc	12 00	14 00

W. I. PIPE DISCOUNTS.

Following are Toronto jobbers' discounts on pipe in effect June 25, 1915:

	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
Standard				
¼, ⅜ in.	63	32½	....	....
½ in.	68	41½	....	....
¾ to 1½ in.	73	46½	....	....
2 in.	73	46½	69	42½
2½ to 4 in.	73	46½	72	45½
4½, 5, 6 in.	....	....	70	43½
7, 8, 10 in.	....	....	67	40½
X Strong P. E.				
¼, ⅜ in.	56	32½	....	....
½ in.	63	39½	....	....
¾ to 1½ in.	67	43½	....	....
2, 2½, 3 in.	68	44½	....	....
2 in.	....	....	63	39½
2½ to 4 in.	....	....	63	42½
4½, 5, 6 in.	....	....	66	42½
7, 8 in.	....	....	59	35½
XX Strong P. E.				
½ to 2 in.	44	20½	....	....
2½ to 6 in.	....	....	43	19½
7 to 8 in.	....	....	40	16½
Genuine Wrot Iron.				
⅜ in.	57	26½	....	....
½ in.	62	35½	....	....
¾ to 1½ in.	67	40½	....	....
2 in.	67	40½	63	36½
2½, 3 in.	67	40½	66	39½
3½, 4 in.	....	....	66	39½
4½, 5, 6 in.	....	....	63	36½
7, 8 in.	....	....	60	33½

Wrought Nipples.	
4 in. and under	77½%
4½ in. and larger	72½%
4 in. and under, running thread	57½%
Standard Couplings.	
4 in. and under	60%
4½ in. and larger	40%

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65%
Sq. Head Set Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45%
Flat & But. Head Cap Screws	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in. N.	70%
Semi-Fin. Nuts up to 1 in.	70%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

METALS.

	Montreal.	Toronto.
Lake copper, carload	$21 50	$21 25
Electrolytic copper	21 25	21 00
Castings, copper	21 00	20 75
Tin	45 00	45 00
Spelter	28 00	28 00
Lead	7 50	7 25
Antimony	40 00	40 00
Aluminum	40 00	40 00

Prices per 100 lbs.

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh	$20 00
Openhearth billets, Pittsburgh	20 00
Forging billets, Pittsburgh	25 00
Wire rods, Pittsburgh	25 00

NAILS AND SPIKES.

Standard steel wire nails, base	$2 40	$2 35
Cut nails	2 50	2 70
Miscellaneous wire nails	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	75
Stove bolts	80
Plate washers	40
Machine bolts, ⅜ and less	70
Machine bolts, 7-16 and over	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes	4¼c per lb. off
Nuts, Hexagon, all sizes	4¾c per lb. off
Iron rivets	72½ per cent.
Boiler rivets, base, ¾-in. and larger	$3.25
Structural rivets, as above	3.25
Wood screws, flathead, bright	85, 10, 7½, 10 p.c. off
Wood screws, flathead, Brass	75 p.c. off
Wood screws, flathead, Bronze	70 p.c. off

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Standard. Price. per ft.	Extra Strong, Sizes Ins.	Extra Strong, Price per ft.	D. Ex. Strong, Size Ins.	D. Ex. Strong, Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.....
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....

COKE AND COAL.

Solvay Foundry Coke	$5.75
Connellsville Foundry Coke	4.85-5.15
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

COLD DRAWN STEEL SHAFTING.

At mill	40%
At warehouse	40%

Discounts off new list. Warehouse price at Montreal and Toronto.

MISCELLANEOUS.

Solder, half-and-half-	$ 0.28
Putty, 100 lb. drums	$ 2.70
Red dry lead, 100-lb. kegs, per cwt.	9.67
Glue, French medal, per lb.	0.18
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.18
Benzine, single bbls., per gal.	0.18
Pure turpentine, single bbls.	0.66
Linseed oil, raw, single bbls.	0.73
Linseed oil, boiled, single bbls.	0.76
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Lead wool, per lb.	0.09
Pure Manila rope	0.16
Transmission rope, Manila	0.19½
Drilling cables, Manila	0.17½
Lard oil, per gal.	0.60

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto 40%

PROOF COIL CHAIN.

¼ inch	$8.00
5-16 inch	5.35
⅜ inch	4.60
7-16 inch	4.30
½ inch	4.05
9-16 inch	4.05
⅝ inch	3.90
¾ inch	3.85
⅞ inch	3.65
1 inch	3.45

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	60
Carbon over 1½ in.	25
High Speed	40
Blacksmith	60
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Centre	25
Pipe Reamers	80

Discounts off standard list.

IRON PIPE FITTINGS.

Canadian malleable, 35 per cent.; cast iron, 60; standard bushings, 60; headers, 60; flanged unions, 60; malleable bushings, 60; nipples, 75; malleable, lipped unions, 65.

TAPES.

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3.50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$3 00	$3 00
Canada plates, dull, 52 sheets	3 10	3 50
Canada plates, all bright	4 25	4 50
Apollo brand, 10¾ oz. galvanized)	6 40	6 40
Queen's Head, 28 B.W.G.	6 50	6 50
Fleur-de-Lis, 28 B.W.G.	6 30	6 30
Gorbal's Best, No. 28	6 50	6 50
Viking metal, No. 28	6 00	6 00
Colborne Crown, No. 28	6 30	6 30

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$10 00	.....
1¼ in.	10 00	.....
1½ in.	10 00	.....
1¾ in.	10 00	.....
2 in.	10 50	9 20
2¼ in.	12 10	.....
2½ in.	13 05	12 10
3 in.	15 75	12 70
3¼ in.	.....	13 90
3½ in.	20 00	15 00
4 in.	25 50	18 90

Prices per 100 feet, Montreal and Toronto.

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50 & 10%
Standard	60%
Cut leather lacing, No. 1	$1.20
Leather in sides	1.10

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	$9.00
¼ in.	6.25
5-16 in.	4.65
⅜ in.	4.00
7-16 in.	4.00
½ in.	4.00

Prices per 100 lbs.

WASTE.

WHITE.	Cents per lb.
XXX Extra	0 10¼
X Grand	0 09¾
XLCR	0 09¼
X Empire	0 08½
X Press	0 07¾
COLORED.	
Lion	0 07⅛
Standard	0 06⅜
Popular	0 05¾
Keen	0 05¼
WOOL PACKING.	
Arrow	0 16
Axle	0 11
Anvil	0 08
Anchor	0 07
WASHED WIPERS.	
Select White	0 09
Mixed Colored	0 06¼
Dark Colored	0 05¼

This list subject to trade discount for quantity.

BELTING RUBBER.

Standard	50%
Best grades	30%

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Toronto, Ont., July 20, 1915.—The industrial situation is in much the same position as last week, and no striking developments have taken place. It is, however, confidently expected that further war orders of considerable size will be placed with Canadian manufacturers. The money already expended in Canada on war equipment is enormous, and will go a long way towards making up for the loss of ordinary trade. The situation as regards the shell industry is unchanged, but considerable progress is being made towards increasing the output of cartridge cases and other shell parts necessary for making complete shells. When Canada is in a position to ship fixed ammunition entirely, orders for shells will again be distributed.

The development of foreign trade is being followed with the greatest interest in business circles, and satisfactory results are expected from the efforts that are being put forth. A good start has already been made, and the outlook is favorable for considerable business in the future.

Steel Markets.

There is a continued heavy demand for bars and forgings for shells, and the entire production of the mills is being rapidly absorbed by our various shops. Although the forging plants have con-

siderably increased their output during the last few months, it is yet hardly sufficient to meet the demand from machine shops. When larger orders for 4.5 shells come to be placed, as they will be, it will mean increased activity at the forging plants and possibly in some cases the installation of more presses.

Merchant business continues quiet, there being hardly any material improvement in the building trade. There is a fair demand for bridge sections, and some inquiries for reinforcing bars have been sent out. The steel pipe trade is comparatively quiet, although the City of Ottawa is in the market for a quantity of 51-in. pipe. Prices of steel products are holding firm.

There is no change in the galvanized sheet situation, as the trade is not inclined to buy spelter at the present price, which is too high to use for sheets. Some mills are refusing to take contracts under present conditions. Galvanized pipe is very firm.

Favorable conditions continue in the steel trade in the States, and production is increasing to keep pace with the demand. There is a heavy demand for bars for shells, and some large contracts have been made. The United States Steel Corporation has advanced quotations on bars, plates and shapes for current or third-quarter delivery to 1.30 Pittsburg.

Pig Iron.

There is no change in the situation as regards Canadian furnaces, although it is stated that a considerable tonnage of low phosphorous iron is being shipped to Eastern points in the States.

Machine Tools.

The shell business continues to occupy the attention of the machinery houses, who are still busy figuring on equipments for making shells. Although no new orders for shells have been placed recently, prospective makers are preparing to do business in anticipation of obtaining contracts later. The situation as regards deliveries of new tools does not improve, and the demand for second-hand equipments is, therefore, being stimulated.

Supplies.

The demand for machine shop supplies continues good, and is likely to continue so. Tool steel is in good demand at the advanced prices. The shortage of supplies of tungsten is causing considerable concern among tool steel makers, and the situation may be said to be acute.

Metals.

There is a weak tendency throughout the metal markets, and copper, tin and lead have all declined slightly, due in the case of the two former metals to weakness in the London market. The spelter situation is unchanged, there recently having been little demand for this metal. There is a continued scarcity of aluminum and quotations are nominal. There is no change in the antimony situation, but prices are holding firm at a dull market. Solders are weaker on account of the decline in tin. Business locally is very good in metals used in munitions, while ordinary business is also improving.

Tin.—The weakness in the London market continues, and there appears to be a lack of confidence there. In New York the market is easier all round, and, except for far-off futures, buyers show no interest. The local market has declined 1c, and tin is now quoted at 45c per pound.

Copper.—The market has declined in London, and is weak and unsettled in New York. Exports from New York have fallen off during the last two or three weeks, and against this, production has been very heavy, which has resulted in the stated weakness. Copper has declined ¼c, and is quoted at 21¼c per pound.

Spelter.—The market is weaker, but dealers are not trying to force business, and prices are unchanged. The large additions to the smelting capacity now under way will increase production, but as this will no doubt be more than consumed, lower prices for spelter are hardly likely under the prevailing conditions. Local quotations are unchanged and nominal at 28c per pound.

Lead.—The market is steadier, but there is a weak tendency. The Trust are holding the price at $5.75, New York, thereby protecting that market. The local market, however, is weaker, lead being now quoted at 7¼c per pound.

Antimony.—The market is dull and unchanged, and quotations nominal at 40c per pound.

Aluminum.—The demand still holds good and supplies are scarce. Quotations are nominal at 40c per pound.

NEW WAR ORDER DEPARTMENT.

SECURING war orders is a dominant though in the mind of the Canadian manufacturer to-day. The new arrangement made by the British War Office for the purchase of supplies in Canada is, therefore, a matter of such importance that every manufacturer should understand thoroughly the basis on which the Imperial business is to be conducted from now on. With a view to securing this information **Canadian Machinery** has spent some time investigating the new system thoroughly.

At the outset it can be taken for granted that the decision of the British War Office, to make purchases of war supplies in Cañada, through the Canadian Pacific Railway, taken in conjunction with the special visit of Sir Thomas Shaugnessy to England, presumably at the request of the British Government, is an indication that the Imperial authorities are anxious to develop the facilities for war material in Canada. The appointment of Sir Thomas Shaughnessy to an office, the powers of which are indefinite, but which may be as broad as those of J. P. Morgan in the United States, and the sending out of D. A. Thomas the Welsh coal magnate as special representative of the British Department of Munitions, are evidences of the fact that the British official eye has been opened as to Canada's capacity for production. Broadly, Canada is to supply a larger share of the war supplies needed by the British Government.

The adoption of the system by which war purchases are made in Canada through the Purchasing Department of the Canadian Pacific took place some months ago. The full significance of this move did not become apparent, however, until Sir Thomas Shaughnessy was called to England. On his return, his statements indicated that he had been able to considerably extend the scope of the Purchasing Department. What special powers were granted to Sir Thomas have not been announced, but there is a general belief that they are much broader than has been officially given out. The machinery for placing orders employed by the War Office, prior to the inauguration of the new system was still in existence for the purpose of closing up the business awarded under it.

The New System.

The War Purchasing Office, as now constituted, is the development of a unit of the Purchasing Department employed by the Canadian Pacific Railway; and the internal machinery for the most part will be the same. That the C. P. R. purchasing system is efficient was demonstrated recently when the city of New York decided to model the Civic Purchasing Department on the same lines. The department has been located at 114 Windsor street, Montreal, on the Windsor street level of the Canadian Pacific Railway depot. The chief of the department is E. FitzGerald, who has been connected with the C. P. R. Purchasing Department for the past 20 odd years. Although assisted by a large and capable staff, the orders will be placed through Mr. FitzGerald, and all communications should be addressed to him.

Tentative Requisitions Supplied.

The methods employed are along the same lines as adopted in the C. P. R. The first step is when a tentative requisition is received from the War Office. This is not a definite order, but a general inquiry as to what the Department can

do in Canada to supply certain goods. Price and date of delivery are both important factors, as it is likely that in all cases there may be other sources of supply receiving competitive consideration at the War Office. Canada, as a colony of the Empire, will be entitled to some special concessions, but it cannot be expected that unreasonable allowances will be made.

The Canadian Purchasing Department, with the general information as to what the War Office needs, then goes to the Canadian manufacturers, and in some cases to jobbers, when there may not be time or opportunity for manufacture, asking for information as to what quantity could be produced and at what price. When prices and particulars are received, they are submitted to the War Office. It is not until the definite order is placed that it is known whether Canada is to get the business or not.

This, in brief, is the system which will be followed. The opinion has been expressed in many quarters that a more satisfactory method would be to make public the particulars as to the requirements of the War Office, thus giving all manufacturers a chance to apply for a share of business. This suggestion was broached by representative of **Canadian Machinery** to Mr. FitzGerald, but it was found that the Department would not consider this form of procedure. The reason for not adopting this plan is that the announcement of large requirements in any certain line would have the inevitable effect of stiffening the price of raw materials. Thus, the cost to the War Office would in the end be increased; and one principle on which the orders are now being placed is that the lowest possible cost, compatible with the essential quality and a fair profit to the maker, must be secured. It was pointed out also that from the standpoint of the Canadian manufacturer high prices were to be avoided for the reason that they would have the effect of turning the orders from Canada altogether. The system of publicly announcing the requirements would be possible if the Purchasing Department were given carte blanche as to price; an unlikely development except perhaps in emergencies.

Thus the system to be followed is as stated above. Some will disapprove of this system, but the fact remains that it is on this basis that the Department will work and the manufacturer who expects to get business must fall into line and make the best of the situation.

What Manufacturers Must Do.

The Purchasing Department claim that they have very complete information as to the manufacturers in each line. They have on file the trade papers of the Dominion and the Manufacturers' Directories published by the Department of Trade and Commerce and the Canadian Manufacturers' Association. It is the earnest object of the Department now, on receiving information of requirements, to communicate with every manufacturer in the Dominion in a position to handle some share of the business. It is in this connection that the individual responsibility of the manufacturer comes into play. Manufacturers or groups of manufacturers who consider that they are in a position to supply from present stock or to produce articles for supplies—anything that might be required by the War Office from shells to canned goods—at prices which would be satisfactory, should lose no time in getting into communication with the C. P. R. War Purchasing Department, so that there can be no question as to their complete possibilities being known to the Department. The War Office may have an accurate line on the capacity of each manufacturing plant in Canada and the stock each manufacturer is carrying at present, but no manufacturer should take this for granted. Give complete information to the Department now. Jobbers in a position to give a close price on stock lines for which there is a strong demand would also be in line for this business.

Many manufacturers have already put themselves in touch with the War Purchasing Office. All others should do so without any delay.

In this way the new system will be made efficiently operative from all standpoints.

Nor is it the intention of the Department, according to Mr. FitzGerald, to give out information concerning orders which have been placed. This, he contends, leads to dissatisfaction in some cases, and to higher quotations for future requisitions in others. This phase of the situation emphasizes still further the importance of each manufacturer keeping closely in touch with Mr. FitzGerald's department. It may be stated, however, that among the articles which have already been purchased through the new Department are: Nails, matches, miscellaneous tools, steel forges, helmets and steel wire rope. Further, it may be stated that at the present time there are a number of substantial orders in the tentative stage. Perhaps **you** are in a position to supply some of the material covered in these orders pending. Make your capacity known.

Extending Scope of Orders.

However, dealing with the requisitions as they are received from the War Office is only one phase of the word of the purchasing department. There is another, which is in a sense even more important, and that is in bringing to

A WORD TO MANUFACTURERS.

Every manufacturer in Canada who is turning out a product which classifies with any of the articles which have already been purchased for the needs of the armies of the Empire, or who believes that he is making or could make an article which could be put to such use—at a fair competitive price—should communicate with the new purchasing department established in Canada by the British War Office in conjunction with the Canadian Pacific Railway. Such information will be used whenever possible to extend the field of purchasing in the Dominion. All manufacturers who are seeking war orders should make sure that their names are on the lists of the purchasing department of the C. P. R. or the new war order branch thereof recently established.

Jobbers may also be in a position to figure on certain lines of supplies when manufacturers cannot meet the requirements readily, but it would appear to be the intention to figure prices closely.

Address,
E. FITZGERALD,
War Purchasing Department, C.P.R.,
Windsor Street, Montreal.

the attention of the Department the possibilities of Canadian industry in relation to the needs of the British forces. It is in this connection that the visit of Sir Thomas Shaughnessy to England takes special significance.

Mr. Fitzgerald is in regular communication with the War Office. Information is being constantly sent forward as to supplies which can be readily secured. Manufacturers individually must strengthen his hand in this regard.

Mr. Fitzgerald was asked as to whether any steps were being taken to secure supplies of raw material to make up orders—as, for instance, cloth for uniforms. His reply was that, so far as he knew, nothing was being done. Canadian manufacturers will have to stand on their own feet in securing raw material. It is not the intention of the Purchasing Department to assist in this respect.

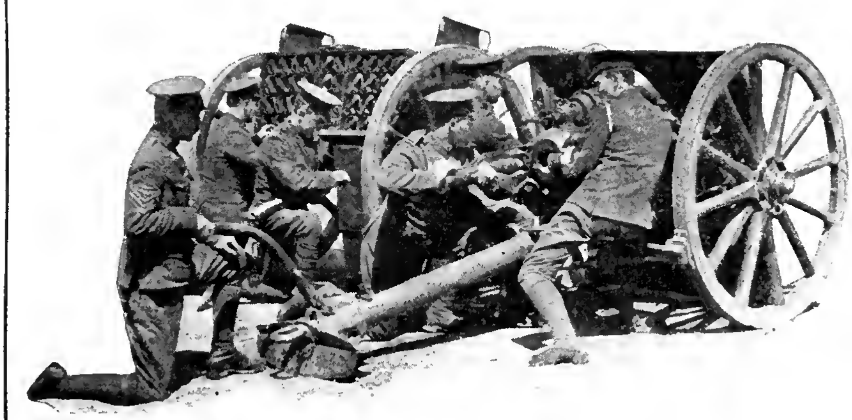
The scope of the C. P. R. War Purchasing Department in placing orders has not been clearly defined. It does not include shells—the shell situation will be dealt with in a later article—and it is officially reported not to include other munitions, but this seems likely to be altered. The Department has wider powers apparently than have yet been announced.

AMERICAN ENGINES FOR BRITISH PATROL LAUNCHES

The Sterling Engine Company, Buffalo, N.Y., manufacturer of motor boat engines, has shipped to London one 250-h.p. 8-cylinder engine, one 100-h.p. six-cylinder engine, and one 50-h.p. four-cylinder engine for motor boat control launches, and submarine destroyers for the British Government. These motor boats are to have a seagoing speed of upward of 30 miles per hour. It is stated large orders for motor engines are to follow. The company has two 300-hp. 8-cylinder engines completed and under test nearly ready for shipment. It has also an order just received for six 150-hp. 6-cylinder engines and one for four 200-h.p. motor boat engines for the Italian Government to cost $12,000.

The Turbine Equipment Co., Toronto, have sold two 750 k.w. non-condensing steam turbine-driven alternators to the Aetna Explosives Co., Montreal, Que.

M. Beatty & Sons, Ltd., Welland, Ont., announce that the control and management of the company has been changed. H. L. Beatty has been elected president, and A. O. Beatty, vice-president and general manager. Harris T. Dunbar, of Buffalo, has been elected a member of the board of directors. V. R. Browning, B. F. Miles, directors, and R. A. Greene, general manager, who have had charge of the business for the past three years, have severed their connection with the company.



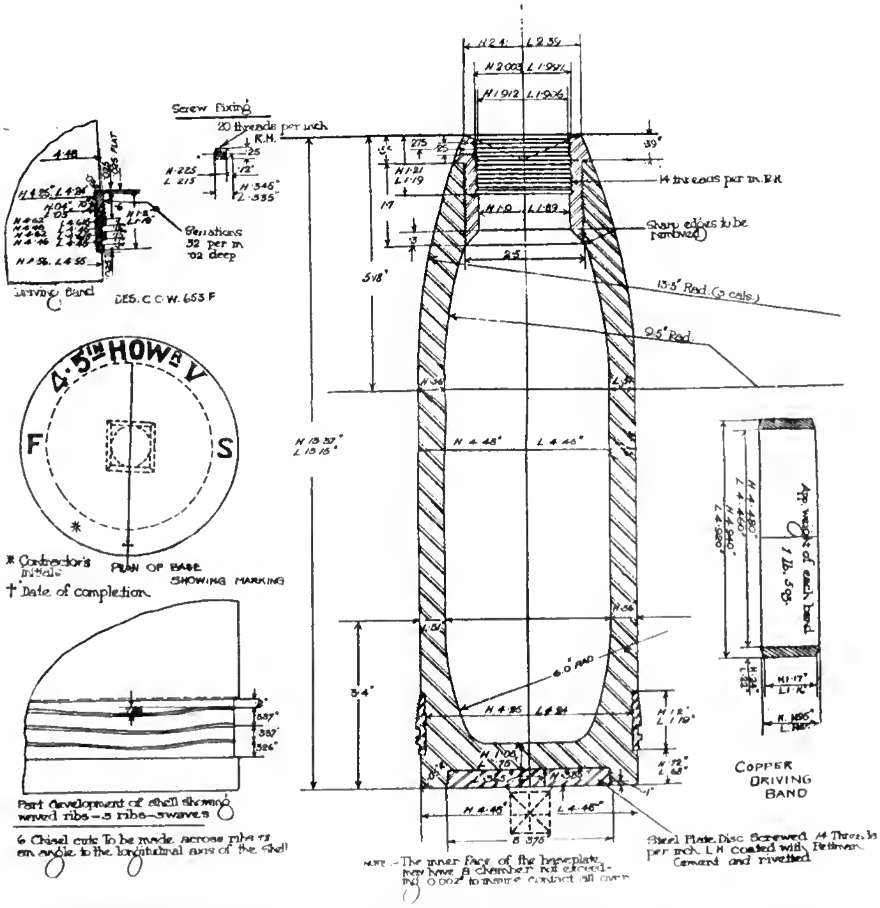
Machining 4.5 H.E. Shells in a Steel Foundry Plant

Staff Article

The sudden call from the manufacture of articles of a peaceful commerce to that of supplying the gods of war with provender of a prodigious amount and such as we never dreamed of producing, has been met by the administrations of our iron and steel industries in a manner that demands whole-hearted admiration for their enterprise, capacity, resourcefulness.

THE forging for a 4.5 howitzer shell is very similar in appearance to that of the 18-pdr. shrapnel, except that it is, of course, of larger dimensions, and being a high explosive shell, the walls are thicker than for shrapnel. As regards the machining operations, the procedure adopted comprices methods used for both the 18-pdr. shrapnel and high explosive shells. The forging being hollow, calls for methods which follow closely along the lines adopted for shrapnel, whereas the later operations conform more to those adopted for the 18-pdr. high explosive, in the matter of the base recess, varnishing, baking, etc. In comparison with shrapnel, a noteworthy exception is the elimination of the heat treatment, this process not being necessary for the various types of high explosive shells. The operation involving the closing in of the shell nose is, however, common to both types, as are also the grooving, waving, copper-band pressing and turning operations.

Notwithstanding the apparent similarity in the operations, as indicated above, the extra size and weight of the 4.5 shell calls for larger and stronger tooling fixtures and in some cases heavier machines. It therefore follows that, in making larger calibre shells, new problems confront even those who may have been successfully making the smaller calibre shells. In the solution of these problems and in overcoming the difficulties encounterered, the prospective manufacturer of 4.5 shells is specially interested. Taken as a whole, the machining of these shells is at present in a more or less experimental stage, but at the plant under review, which, by the way, was one of the first to undertake the manufacture of 4.5 shells, these problems have been surmounted successfully, although in some operations improvements are contemplated with a view to increasing production. In the main, however, the operations to be described later may be said to be of a permanent character.

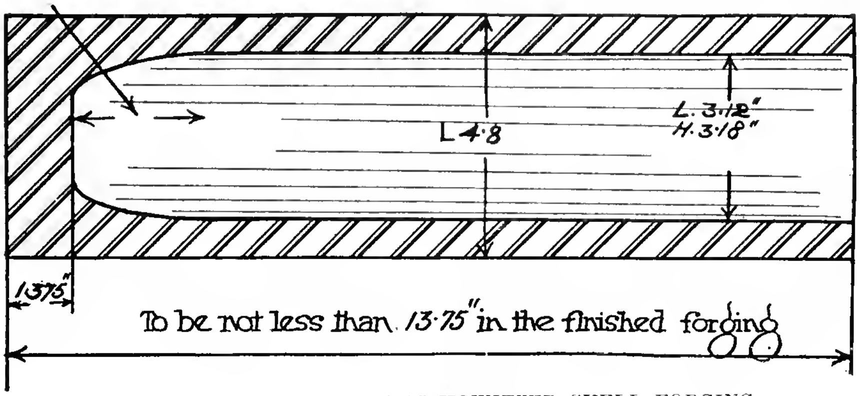


Q.F. HIGH EXPLOSIVE 4.5 INCH HOWITZER SHELL, MARK V/L/, FORMED FROM STEEL BILLET 4.8 INS. DIA. BY 9½ INS. LONG AND WEIGHING 49 LBS. WEIGHT OF FILLED SHELL 35 LBS. PLUS OR MINUS 9 DRS. WEIGHT OF BURSTING CHARGE (TROTYL), 4 LBS.

In the manufacture of the 4.5 shells great care has to be exercised in keeping the weight within the prescribed limits. The feature is, of course, common to shells of smaller calibre, but none the less important for the larger shells. The walls also be of uniform thickness and the shell perfectly concentric. To obtain this concentricity, the shell has a centre drilled in the base, which is retained as long as possible and in all operations involving the removal of metal, the shell revolves in this centre.

An important point to watch is during the nosing operation. After the nose has been heated and closed in, the shell must be put in a place, preferably a steel box, away from any cold draft and allowed to cool

slowly. This avoids the possibility of the shell, which is of 45 to 50 carbon, from hardening at the nose. It is also essential that the threads in the nose should be absolutely accurate; the same remark applies to the base plate or plug. There are only a few threads in the base, but the plug must bottom in the recess, and at the same time be a very tight fit. The reason for recessing the base is, of course, the same as for the 18-pdr. high explosive, to enable the inspector to detect any flaw or "pipe" in the metal at the base, and thus avoid any possible explosion when firing.



Q. F. HIGH EXPLOSIVE 4.5 HOWITZER SHELL FORGING.

Accurate gauging is, of course, of the greatest importance, and high and low gauges are used at practically every operation. With regard to obtaining the necessary weight, a system is followed of keeping the shell overweight until the body is turned to the finished size, the extra metal being left on the base and removed to obtain the required weight. The operations involved in this will be described later.

The Forging Feature.

As already stated, the 4.5 howitzer shell is made from a hollow steel forging and not from a solid rolled steel bar, as in the case of the 18-pdr. high explosive shell. The forging is made from a billet or blank 9½ in. long by 4.8 in. diameter and weighing 49 pounds. The ingot from which the blank is obtained is made of cast steel, two blanks being cut from each ingot. After forging, the shell case is 4.8 inches outside diameter and not less than 13¾ in. long over all, the weight, of course, not being a fixed quantity on account of the ragged ends and consequent variation in length.

The finished shell when ready for shipment weighs 27 lbs. 14 ozs., exclusive of the nose cap and explosive charge, while the weight, when ready for service, is 35 lbs., which includes 4 lbs. for the bursting charge. The shell weighs 24 lbs. after the varnishing operation, exclusive of the base plate and nose socket. The over-all length of the shell finished, but without the socket is 12.71 inches. The inside finished diameter of the straight part of the case is 3.406 inches and the outside is 4.46 inches. The base is 15/16 in. thick finished.

Cutting Off Ends..

After the cases have been received from the forge, the first thing to be done is to square up the open end and cut off the superfluous metal. At this plant an axle lathe, made by the Bridgeford Machine Tool Works, Rochester, N.Y., is used for this operation. The illustration shows the drive gear housing in the centre of the lathe and the drive plate, on both sides to which are fastened special clamps for holding the shells. The tool holders are in front on the cross slide. This machine is motor-driven, the motor being located at one end of the bed to the left hand. Before the shells are put in this machine they are marked off on a bench, so that the operator knows how much metal to remove.

Facing Up Base and Centering.

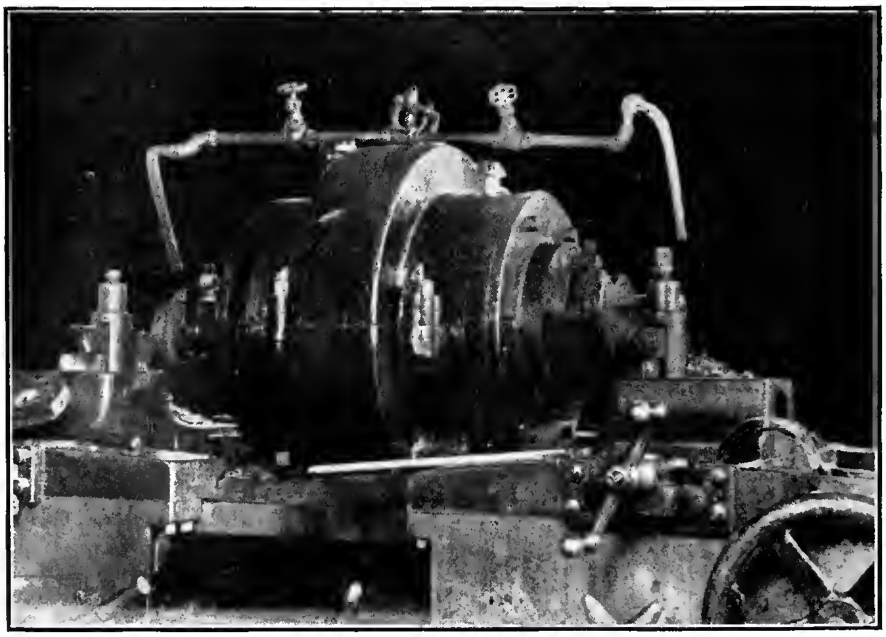
Previous to drilling the centre in the base, the shells are taken to a Bertram planing machine for the bases to be cleaned up. On either side of the table are two long castings with a series of grooves to take the shell cases. The castings are held securely in position by knee brackets bolted to the planer table. The cases are held by clamps, two cases to a clamp bolted to the casting. The planer is equipped with two tools, and a roughing cut only is taken off, sufficient metal being left to permit weight adjustment at a later stage.

To keep the shell cases as concentric as possible during the subsequent machining operations, a centre is drilled in the base. This centreing is done on an engine lathe, the shell being held on a taper mandril while a countersunk drill is performing the centreing operation.

Rough Turning.

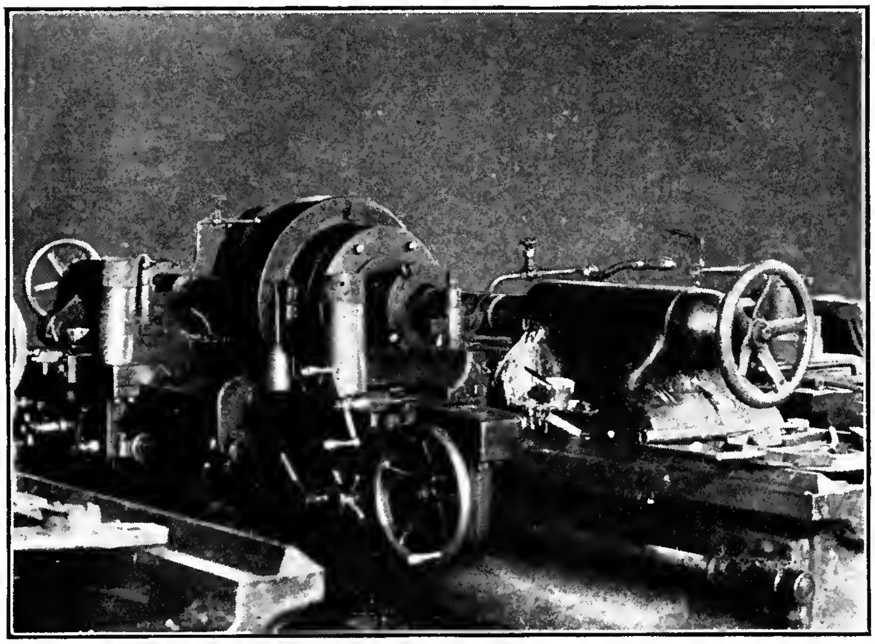
The rough turning operation is performed on a "Bridgeford" axle lathe of the same type as issued for cutting off the shell ends. To each drive plate is attached a self-centreing chuck with a taper stop in the centre for engaging with the open end of the shell. At the face of the chuck outside is a driving ring with four set screws which are tightened up on the shell. The base centre revolves on the tailstock centre. An ordinary turning tool is used and one roughing cut is made. The shell lying on the lathe in the illustration shows how far the machining is carried at this operation, which is equivalent to the length of the straight part.

After rough turning, the base of the shell inside is spot drilled in order to



CUTTING OFF OPEN END OF SHELL CASING ON AN AXLE LATHE.

relieve the cutter when boring at the next operation. A "Bertram" two-spindle drill is used for this work, each shell being held securely in a box chuck or vise fastened to the drill table.



ROUGH TURNING SHELL CASING ON A "BRIDGEFORD" AXLE LATHE.

Inside Boring and Inside Bevel.

The work done at this operation consists of roughing and finishing boring inside the shell case, forming the base inside to the correct shape and forming inside bevel at the nose. The machine used for this operation is a Warner & Swasey turret lathe equipped with a self-centreing chuck and steady rest to support the chuck owing to the long overhang.

The first turret face holds a boring bar with a cutter at the end for boring out the inside for a short distance to give the next tool a better start. The second turret face holds a four lip hogging cutter for roughing out inside. The third turret face has a boring bar with cutter which makes another cut inside and also forms the base inside. The profile of base will be seen in cross section of the shell on another page. The fourth turret face makes the finishing cut inside the shell and also finishes the profile inside of base. The fifth turret face holds a taper cutter for boring the inside bevel to the nose. This inside bevel and the outside bevel also, are formed so that after the nose has been closed in, it is the required shape and size.

Outside Bevel and Facing Base.

Immediately following the operation described above, the shell is taken to an engine lathe to have the outside bevel formed which finishes the preparation of the nose for the closing-in operation. Two engine lathes supplied by the R. McDougal Co., Galt, Ont., are installed for this purpose. Each lathe is equipped with a self-centreing chuck supported by a steady rest attached to the lathe bed. An ordinary turning tool is used. The bevel is $1\frac{3}{4}$ ins. long and begins $1\frac{1}{2}$ inches from the nose. The accompanying sketch shows the inside and outside bevels and their relation to the nose after closing.

Before being taken to the bulldozer for the nosing operation, the base of shell is faced up on an engine lathe supplied by the American Tool Works Co., Cincinnati, Ohio. The shell is held on an expanding mandril which has a bar in the centre and projection at the end, working against three grips at the front and back of the mandril. When the shell is placed on the mandril it is forced up against the chuck, the inside of the base engages with the bar in the mandril and thus forcing out the grips and holding the shell tight. A roughing cut is taken off the base by an ordinary tool, after which the shell is ready for the nosing operation.

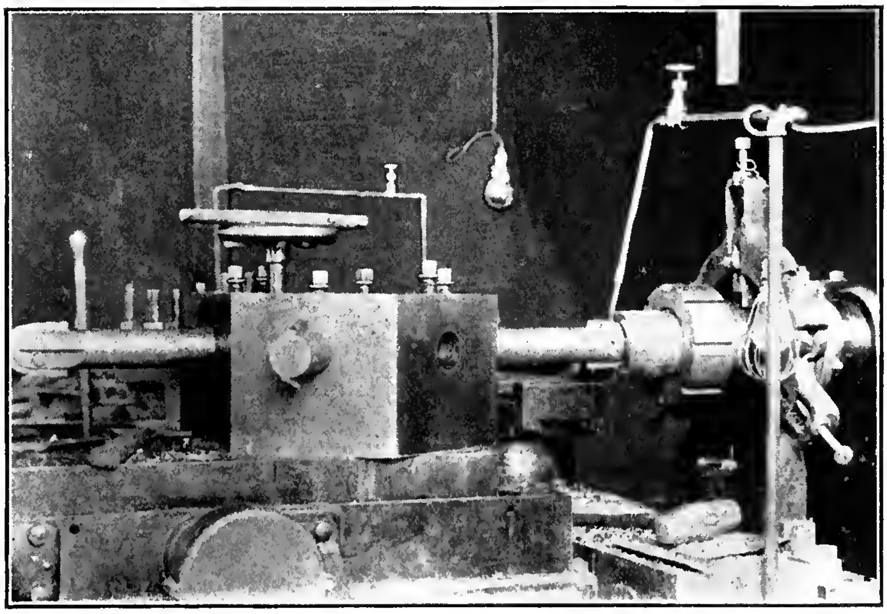
Closing-in of Nose.

The accompanying illustration shows clearly the general feature of the bulldozer used for this operation, and shells resting on the press show the shape of the nose before and after treatment. In the centre of the ram will be seen the die which is conical inside and has a water jacket outside supplied with water through the pipe above. The shell is supported horizontally on a bracket, not seen in the illustration, fastened to the long casting in the foreground.

The nose only of the shell is heated in the oil-fired furnace located on the right. Care is taken that only a certain length of shell is heated, otherwise it might break down in the press. When heated to the required degree, the shell is taken out of the furnace, placed in the bulldozer, the ram of which advances and closes in the nose. The shell is afterwards taken out and placed in a steel box so that it may cool gradually to avoid all possibility of the nose hardening.

Centreing Base.

Before the shell is ready to have the nose finished, a centre is drilled in the base on a drill press supplied by W. F. & J. Barnes, Rockford, Ill. The shell is held in a vise base end up, and a jig is placed over the end to ensure the centre being drilled in the correct place. The



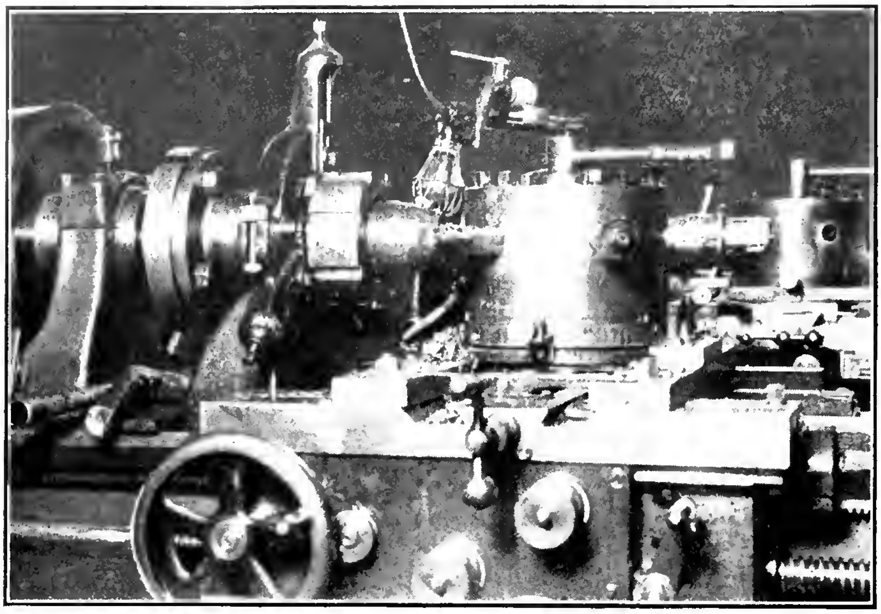
ROUGH AND FINISH BORING INSIDE OF SHELL AND FORMING INSIDE BEVEL.

inside of the nose is now ready to be finished off.

Finishing and Threading Nose.

For this operation one "Walcott" engine lathe equipped with a turret, and two turret lathes supplied by Schumacher & Boye, Cincinnati, Ohio, are installed. All these machines are tooled up in the same manner and are equipped with self-centering chucks supported by steady rests fastened to the lathe bed. The first turret face holds a bar for locating the shell in the correct position in relation to the tools. The bar has a small cutter at the base for cutting the shell to lengths, being gauged from inside base. The second turret face holds a bar with cutter for roughing inside the nose. The next is a bevelling tool for cleaning up that part of the nose inside and beyond the part to be threaded.

The fourth tool is a reamer for finishing the nose previous to threading which is done by a "Murchey" collapsible tap held in the fifth turret face. The shell is now finished inside and is taken to a bench where a pug centre is screwed in the nose to hold the shell in the lathe at the next operation.

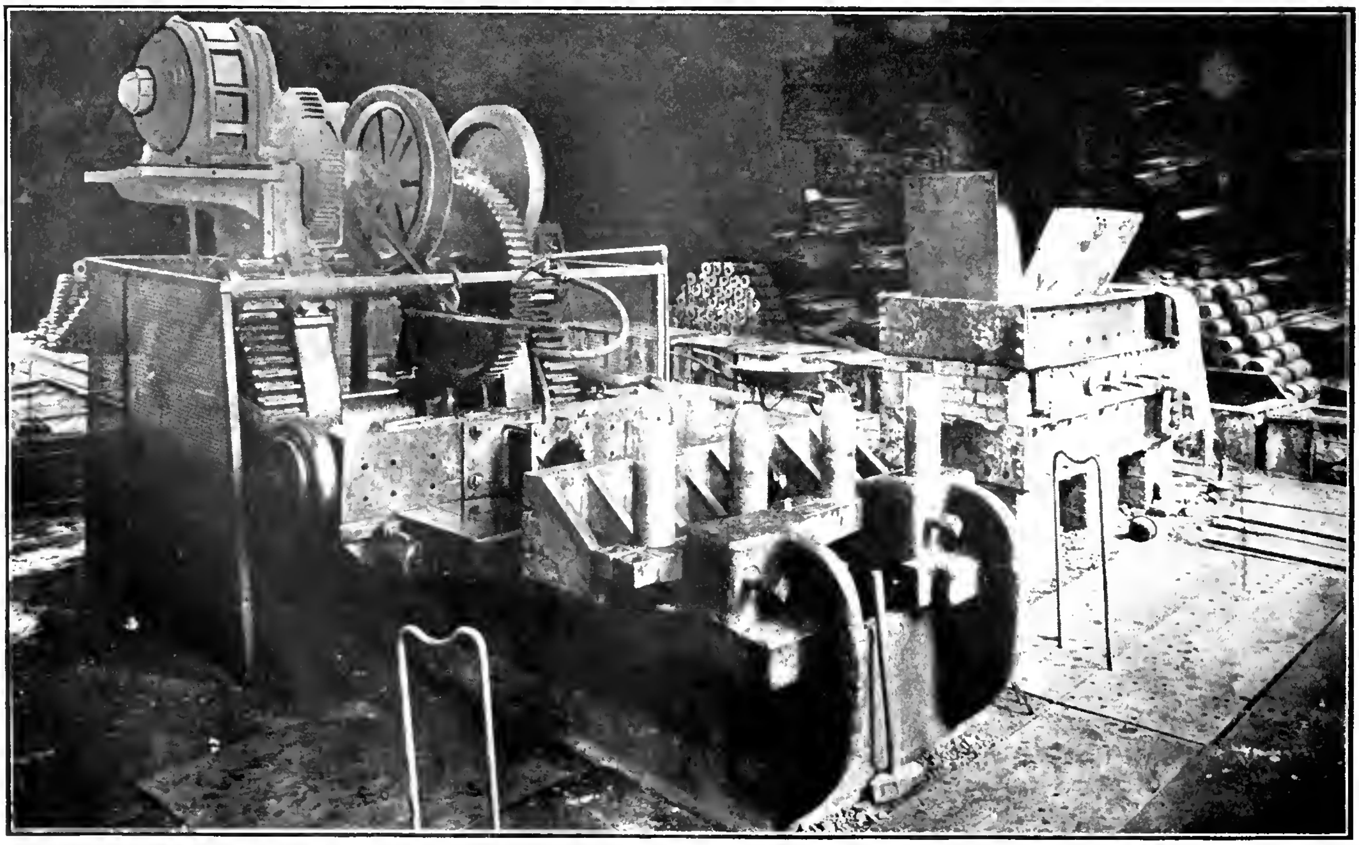


FINISHING INSIDE OF SHELL NOSE AND THREADING SAME.

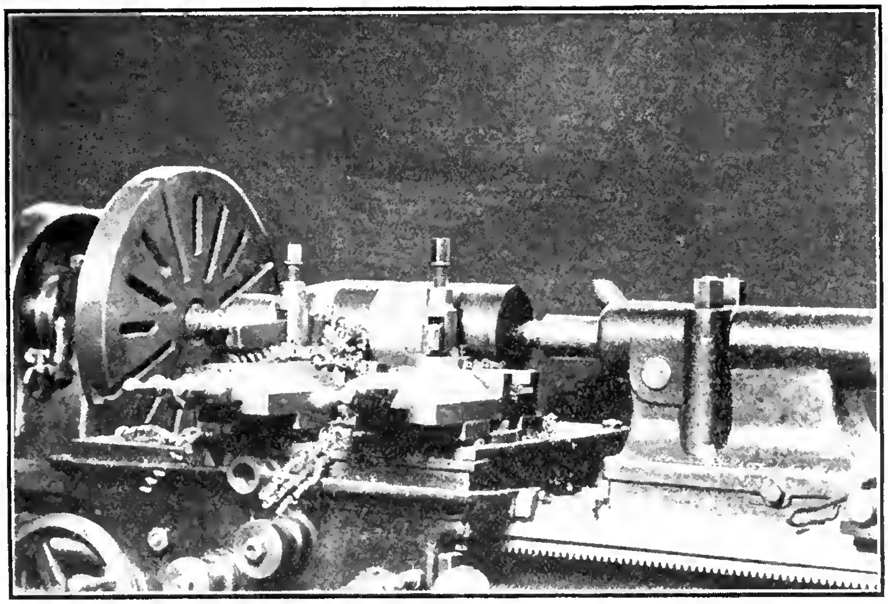
Finish Turning Body.

Five engine lathes built by the R. McDougall Co., Galt, Ont., are installed for finishing the outside of the shell. One of the lathes is equipped with two cross slides and tool holders as shown in the illustration. This arrangement enables two cuts to be taken at a time, thereby increasing production. The other four lathes have only one tool and slide, but are the same in all other respects. The base of the left hand cross slide projects at the back and engages with a cam on a bar fastened to the lathe bed at the back. There is also a weight hanging over at the back, connected to a cross slide to hold the slide bar up to the cam, and so give the correct profile to the nose when the tool is cutting.

In the machine illustrated, the left hand tool turns the nose only and the right hand the straight part only. One tool starts at the nose, and the other at the shoulder, both travelling toward the base. The lathe with only one tool makes but one cut which starts at the nose and finishes at the base. The cam attachment at the back takes care of the nose profile, the same as in the other lathe described. The shell is revolved by a bracket bolted to the face



CLOSING-IN SHELL NOSES ON A BULLDOZER. OIL-FIRED NOSE HEATING FURNACE AT THE RIGHT.



FINISH TURNING OUTSIDE OF SHELL.

plate and engaging with the square end of the nose plug centre.

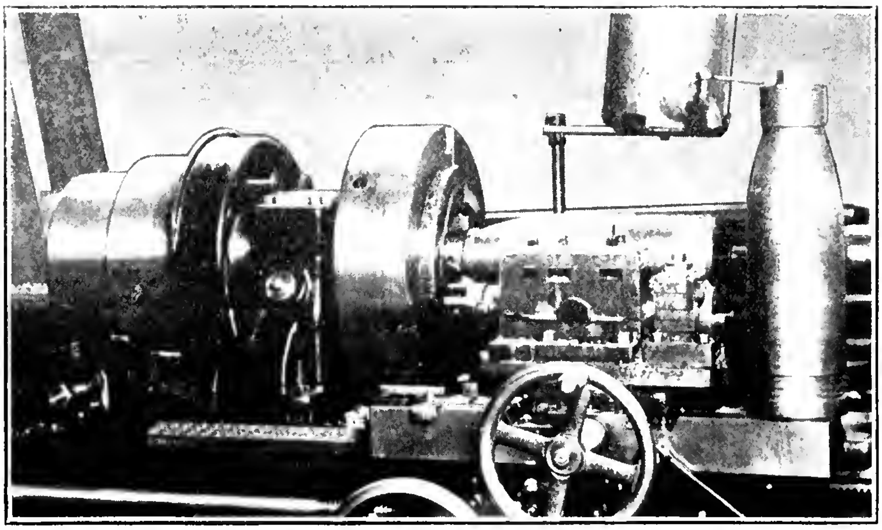
Weight Adjustment.

On the completion of the above operation, the nose plugs are taken out and the shells weighed and inspected. During all preceding operations the shells have purposely been kept overweight in order to be on the safe side, it being easy of course to remove metal but impossible to add any. This extra weight is left on the base and is removed after the amount has been determined by the inspector who weighs and marks each shell before it is taken to the lathe.

For facing the base to weight, an "American" engine lathe equipped with a universal chuck is installed, and also a "Gardner" engine lathe. This is a plain job and does not call for particular mention. The centre at base has by this time been considerably reduced and so requires making larger. This operation is performed in an engine lathe built by the Bradford Machine Tool Co., Cincinnati, Ohio. The shell is held in a self-centreing chuck supported by a steady rest. The shells are next weighed and inspected, and the nose plugs screwed in again.

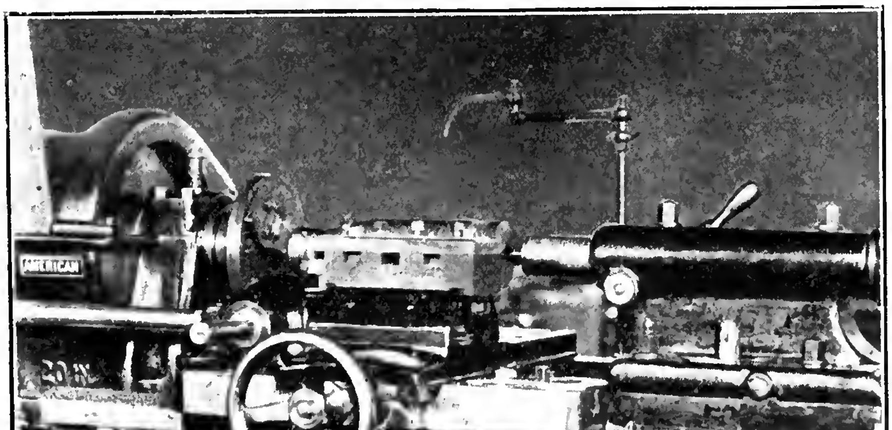
Grooving Undercutting and Waving.

It will be noticed from the illustrations that two methods are employed for machining the driving band recess. The principal difference between the two types of machine installed is in the method of oscillating the tool holder when forming the wave lines. In both cases the sequence of operations is the same and the cutting tools are arranged in the same order, viz., grooving, undercutting and waving. The difference is in the latter operation, a cam being used in one case and an arrangement of shafts and gears in the other machine. Both will be dealt with in detail. The machine installed for performing this work consists of a 20-in. engine lathe built by the American Tool Works, Cincinnati, Ohio, two engine lathes by the Canada Machinery Corporation, Galt, Ont., and one engine lathe by R. Gardner & Sons, Montreal, Que. The "American" lathe is equipped with the special waving gear and the other lathes have a cam, attached to the chuck.



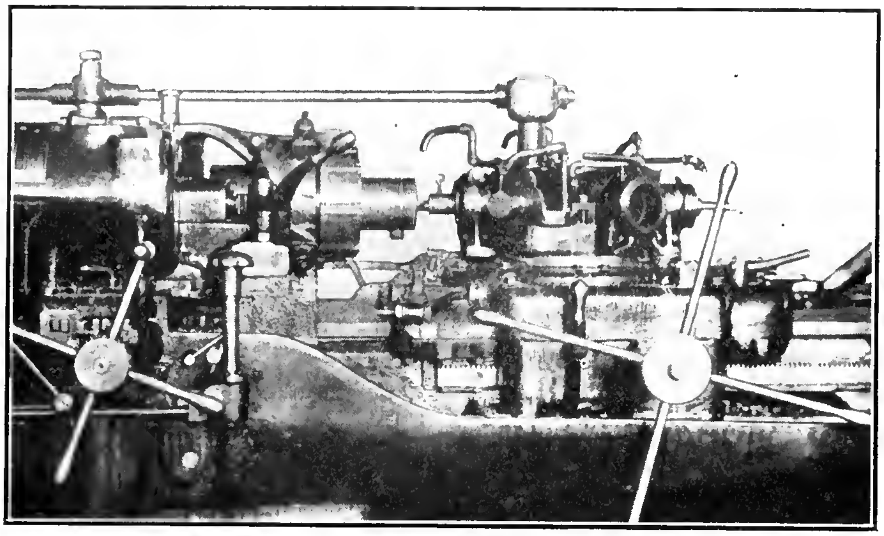
GROOVING, UNDERCUTTING AND WAVING FOR COPPER BAND ON A C.M.C. LATHE.

The illustration shows the general arrangement of the "American" lathe which will be described first. A plug centre has already been screwed into the nose, the square end of which engages with an attachement bolted to the lathe face-plate, thus revolving the shell. The tailstock centre engages with the centre at the base of shell. The location of the groove from the



GROOVING, UNDERCUTTING AND WAVING FOR COPPER BAND ON AN "AMERICAN" LATHE.

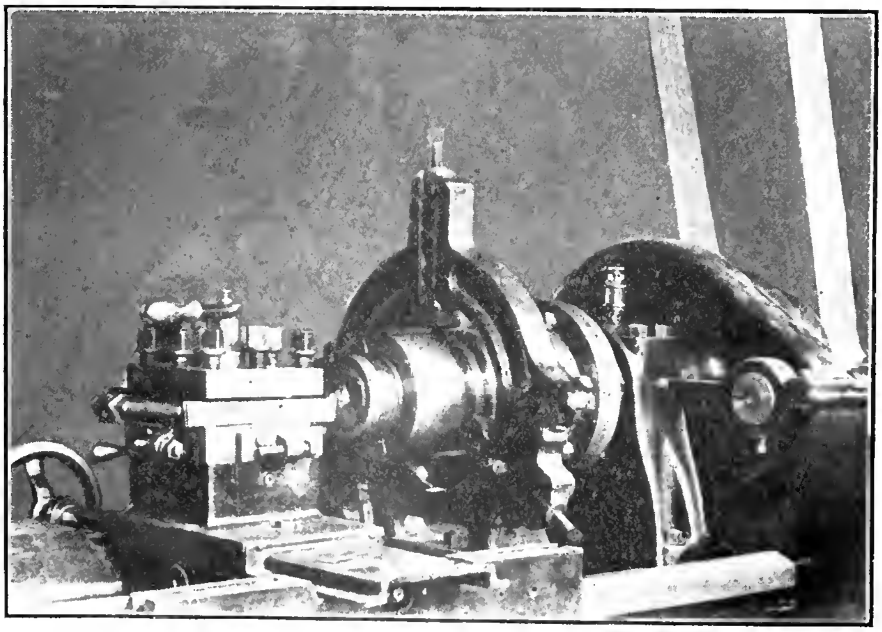
base is determined by means of a suitable gauge. The lathe saddle is moved along until the left hand or grooving tool is in position. The operator then moves the cross slide inwards, thus cutting the groove. The saddle is next moved back until the middle or undercutting tool is in position.



RECESSING AND THREADING SHELL BASE ON A JONES & LAMSON FLAT TURRET LATHE.

This tool has two small cutters projecting outwards diagonally at the same angle as is required for the undercut. When cutting, the saddle is moved along slightly one way until the shoulder of the cutter is up against the edge of outside of the groove, the same method being followed for the other side. The undercutting being completed, the tool is withdrawn and the saddle moved along until the right hand or waving tool is in position. The tool holder for this operation is oscillated by means of the shaft and gears located on the left hand of the cross slide. The shaft is driven by gears in a gear box located at the extreme left of the headstock, and can be put in or out of gear by a lever at the will of the operator. It may here be remarked that this arrangement is only used during the waving operation, and also that the shafts have long keyways and can therefore slide in or out without interfering with the motion of the saddle or cross slide. Three wave lines are cut as against two for the smaller shells.

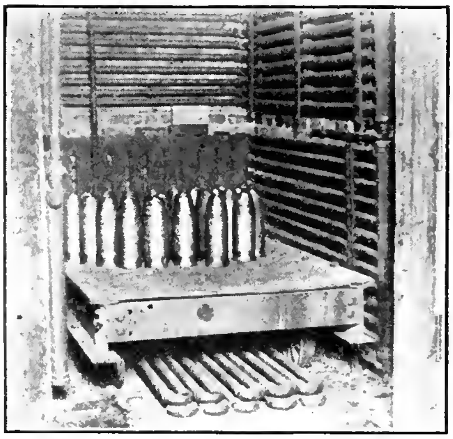
The tooling fixture on the Canada Machinery Corporation lathes, which was designed and constructed by the Canadian Steel Foundries, Ltd., has all the cutting tools at the front, but the waving attachment is separate, and the usual cam being employed for oscillating the waving tool. The shell has the same plug centre but is held in a universal chuck equipped with a three point cam. The method of operation as regards to the grooving and undercutting is the same as for the "American" lathe. The same shaped cutting tools are used and in the same order, it will therefore be unnecessary to describe them again. The illustration shows the wide box tool holder with the tools in the left and right hand slots. The smaller holder to the right hand holds the waving tool which is shown in operation. The saddle is locked and the roller in the round bar running through the larger tool holder is pressed up against the cam which transmits the oscillating motion to the tool; a strong spring under the bar keeps the roller against the cam. The depth of cut is regulated in all cases according to an index on the hand wheel, this being checked by gauges.



ROLLING BASE PLUG AND FACING-UP SHELL BASE.

Base Recess.

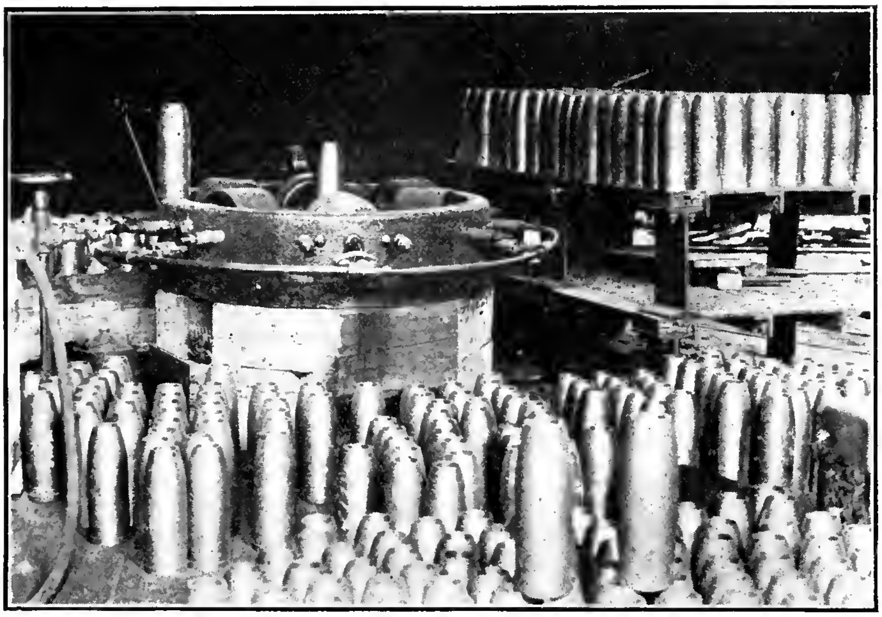
At the next operation, the base is formed and threaded. A battery of six "Hartness" flat turret lathes built by the Jones & Lamson Machine Co., Springfield, Vt., are installed for this work. The ordinary chuck was too light for the work so the machines were equipped with special self-centreing chucks, and, on account of their long overhang, a support in the form of a bracket was devised. The top part of the bracket is fastened to the lathe head, while the lower part rests on and is bolted to the lathe bed. This arrangement holds the chuck steady and prevents vibration. Before the shell is chucked, the plug centre is taken out. In the centre of the chuck is a mandril with a spring at the end. This spring has a tendency to force the shell out while it is being placed into position in the chuck by a swinging arm on the front part of turret. By means of this arrangement the shell is located in the correct position in the machine. The arm when not in use lies flat on the turret bed.



VARNISH BAKING OVEN.

The first tool is a flat drill which is used for obtaining sufficient clearance for the roughing cutter which is held in the second turret and which roughs out the base and sides. In the third turret face is a cutter of similar design to the preceding one, this being used for finishing the bottom of base and side, preparing the latter for the threads. The fourth tool is a cutter for finishing the recesses in the base for the threads to start and finish in. The fifth tool is a chaser for cutting the threads. This is a somewhat delicate operation and requires considerable care. The chasing tool is operated by a special attachment for giving the threads the desired pitch of 14 threads per inch. The lead screw is behind the turret face and the gear box is shown above the turret in the illustration connected to a shaft from the lathe head. The threads in the base are left hand.

The machine head of the lathe is traversed by hand for diameter feeds. A series of bar stops under the head are used for cross or diameter feeds, each stop being set in conjunction with its corresponding turret tool. A similar arrangement of stops is used under the turret for longitudinal feeds.



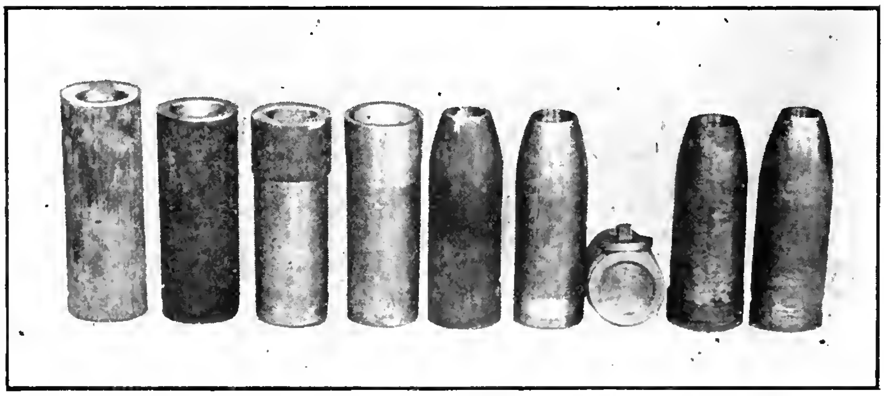
CANADIAN STEEL FOUNDRIES COPPER BAND PRESS.

Inspection, Etc.

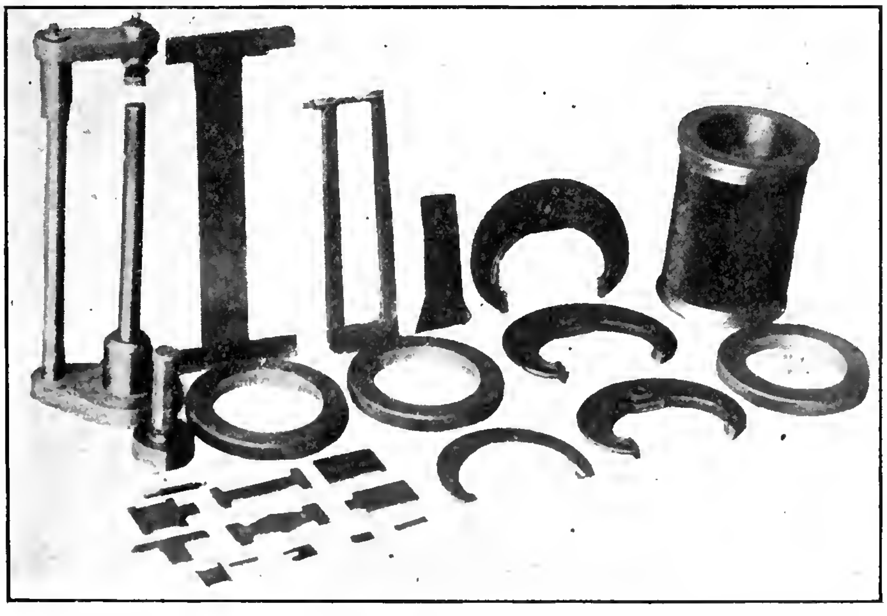
A number of minor operations now follow, the most important being the inspection. The shells are carefully gauged and inspected and then taken to the sand blast where the inside is cleaned and prepared for the varnishing process. The wave lines are next nicked with a cold chisel after which the nose and base recess threads are hand tapped. The shells are then subjected to the preliminary government inspection, the marking being stamped on and the shells arranged in batches of thirty.

Finishing Base.

The plate which is screwed into the base recess is a steel drop forging similar to that used for the 18 pdr., H. E. shell, only of course larger. The base plate is turned on an engine lathe equipped with a special expanding chuck for holding the square head of the plate. The lathe has a turret holding three tools. The first turns the inside diameter in two cuts, the second being the finishing cut for the threads. The second tool forms the camber on the face of the plate, two cuts being made for this. The third turret face holds a tool for cutting the threads on the base plate.



THE 4.5 HIGH EXPLOSIVE SHELL IN ITS VARIOUS STAGES OF MANUFACTURE FROM THE FORGING TO THE FINISHED PRODUCT.



GAUGES USED IN THE MACHINING OF 4.5 HIGH EXPLOSIVE SHELLS.

Before the base plates are screwed into the base recess, the threads are covered with "Pettman's" cement. The shell is held securely in a bench vise and the plate screwed in by means of a wrench. Before being taken out of the vise the square head on the base plate is wrenched off.

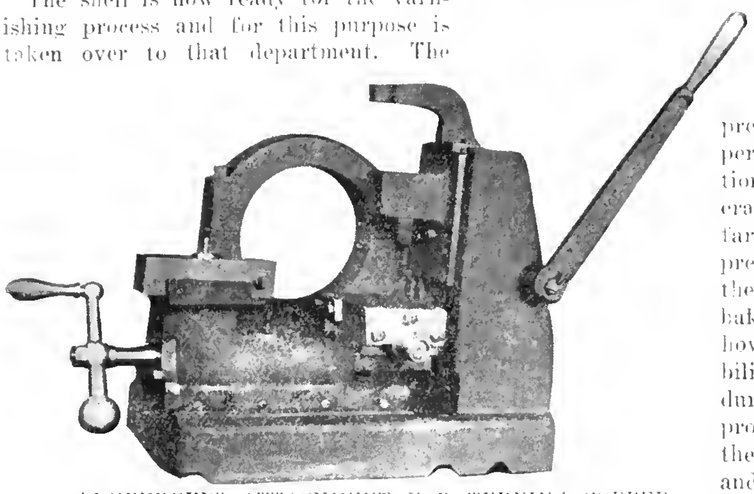
The base is finished on an "American" engine lathe equipped with an expanding chuck and draw-back mechanism. The chuck is supported by a steady rest as shown in the illustration. The tool holder contains three tools—two cutting tools and a rolling tool. The base plate, which projects slightly

when in the shell, is first rough machined, and then faced up by the second tool flush with the base of shell proper. The joint between the base plate and base is now closed by the rolling tool after which the entire base is faced up and finished.

Varnishing and Baking.

The shell is now ready for the varnishing process and for this purpose is taken over to that department. The varnish it will be remembered protects the inside of the shell from the corroding effect of the explosive. A hollow brass plug is first screwed into the shell nose to keep the varnish from the threads. The shell is filled with varnish which is immediately poured out and the shell placed on a draining rack, leaving only a thin film of varnish all over the inside.

For the purpose of hardening the varnish, the shells are placed in an oven for 8 hours at a temperature of 300 degrees Fahr. As will be seen from the illustration, the oven is built of brick with wooden doors, insulated with asbestos to prevent radiation. The oven is steam heated and contains steam pipes all around the walls and on the floor. The truck shown in the oven is only a temporary arrangement, as it is proposed to have a truck capable of holding three tiers of shells, which will fill the oven. It will be noted that the baking has preceded the copper band operations. The general practice so far has been to press the band on the shell before baking. There is, however, a possibility of the heat during the baking process expanding the copper band and thus loosening it. This point, however, has not been definitely settled, and as far as equipment is concerned, it is immaterial which operation is performed first.



"LYMBURNER" ATTACHMENT FOR TURNING COPPER BAND.

Copper Band Press.

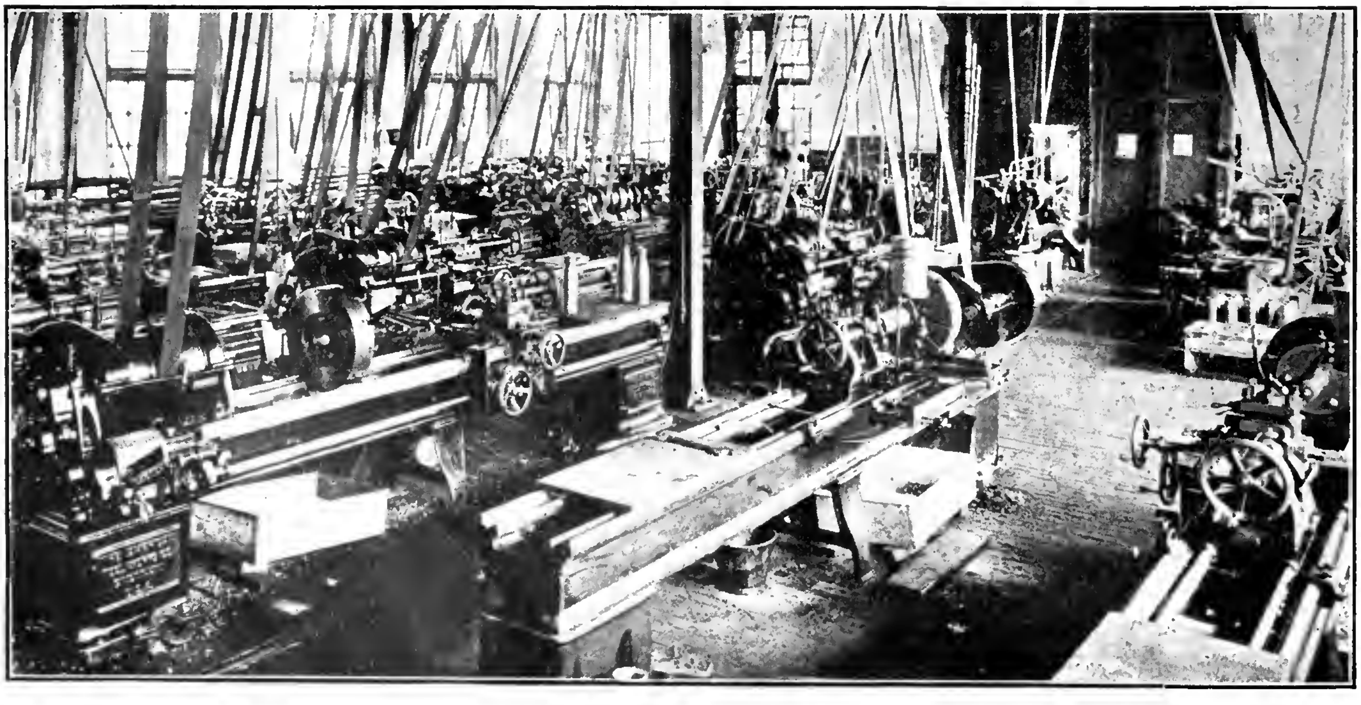
The hydraulic press for pressing on the copper driving band was built by the Canadian Steel Foundries, Ltd., Montreal, Que., and generally speaking it is very similar in design to some other presses on the market, although not quite so high off the floor, an advantage when handling heavy shells. The press has six cylinders which converge towards the centre. The shell with the rough copper band on is placed on the plate in the centre of the press, and the power applied. The pressure is then released the shell given a slight turn and power applied again thus equalizing the pressure on the band. The cylinders are returned to their original position by springs shown outside the press frame.

An engine lathe equipped with a "Lymburner" attachment for turning copper bands is used for finishing the driving band. The attachment is fastened to the lathe bed and has a cross slide in front for the roughing tool and bracket at the back with a vertical slide for holding the finishing tool. The front cutting tool is brought into operation first and the roughing cut made. The back tool is operated by a lever and passes down behind. It is set so that in passing it removes or shaves off the necessary quantity of metal. The cutting tools are of special form to cut the driving band to the required form and also the serrations which are 32 per inch.

Final Operation.

The shell is now complete with the exception of the brass socket. The hollow plug has been taken out and the brass socket screwed in the nose. These sockets are practically finished when they are received at the plant, and the only machining to be done after being put in the shell is to turn the outside of the socket to conform to the profile of the shell nose. The work is done on an engine lathe.

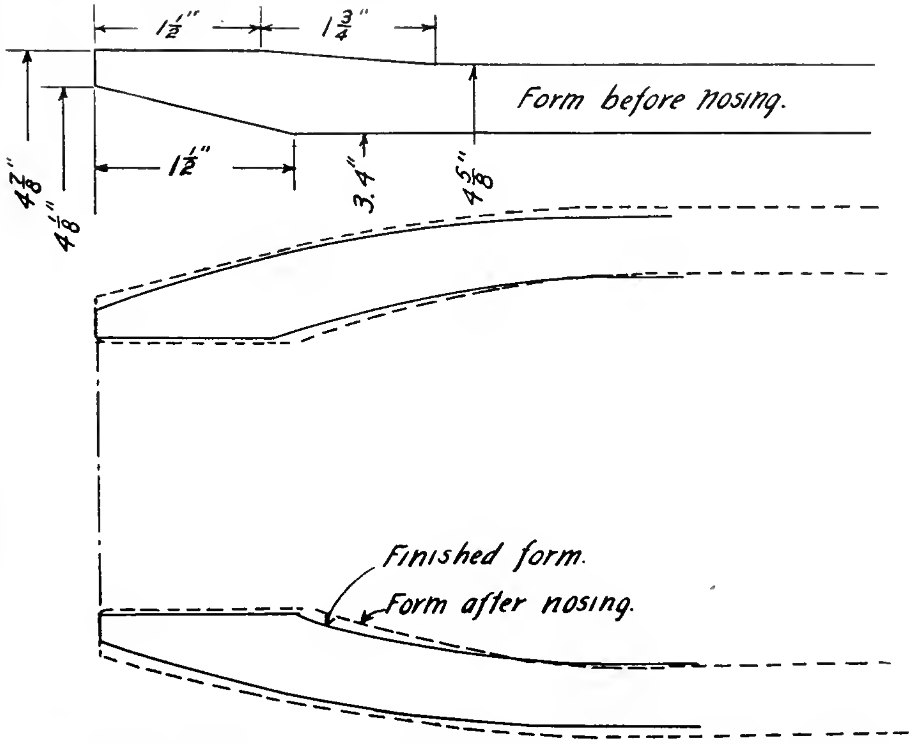
Between the various operations where it has been necessary to move the shells



GENERAL VIEW OF MACHINE SHOP, SHOWING SHELLS IN PROCESS OF MANUFACTURE.

any distance, they have been moved in boxes holding lots of thirty. These boxes are raised off the ground to allow of their being moved by the "Chapman" elevating and transveying trucks, several of which are in use at this plant.

The shells now undergo the final government inspection, and are carefully weighed and gauged, one of each series being selected for the firing test. They are then painted, dried and packed for shipment.



OPEN END OF SHELL FORM BEFORE AND AFTER NOSING. DOTTED LINES SHOW MACHINING REQUIRED BEFORE THREADING NOSE.

List of Gauges.

Thickness of base (finished).
Length of body outside (finished).
Thickness of walls.
Radius of head of shell.
Diameter of driving band.
Cylinder gauge.
Threads in nose.
Diameter driving band, high.
Diameter driving band, low.
Diameter of body, h. & l.
Diameter of body, low.
Diameter of waved ribs, h. & l.
Diameter of recess in driving band.
Form of driving band.
Shape of nose on shell body.
Fixing screw hole and threads.
Width of driving band and distance from base.
Fuse hole recess.
Diameter and shape of socket head.
Depth of base plate recess.
Width of driving band recess.
Height and shape of wave ribs.
Distance of fixing screw hole from top.
Shape of serration.
Undercut in driving band.

POST BELLUM COMPETITION.

AFTER the war, competition with Germany is to be more severe than before, and it is imperative for American manufacturers to cut their costs to the bone, and do it in a hurry. Such is the view expressed in a recent address by Robert Grimshaw, consulting engineer and lecturer in New York University, who, although an American citizen, lived many years in Germany. He has come from that country within a year, and is thoroughly familiar with conditions in Germany and the United States.

Mr. Grimshaw says that after the war there will be in Germany alone at least two million men who will return home and find that they have no jobs. Some of them will see that factories where they worked before the war have been closed, and some of them will discover that their jobs have been filled by women and children. Mr. Grimshaw believes that these men will be put to work at about 50 cents a day, and that the product of their hands is going to be dumped upon this and other countries. He also says that there is a large class of work being done now in Germany, but the product cannot be shipped on account of war conditions. He believes that as soon as peace is declared and ships are free to travel without being molested, this product of the war period will also be dumped in the United States and other countries now at peace.

These are statements worthy of the most careful consideration by everyone who has at heart the welfare of our work people. In discussing the question as to what is to be done about it, Mr. Grimshaw says that the tariff is usually made by people who do not know anything about it, or else by those who know too much about it and consult their own interests instead of those of the general public.

There is a great deal of truth in this statement, and it is high time to begin a scientific investigation to determine as nearly as possible what kind of a tariff bill should be enacted. This should be done by a non-partisan commission, and done thoroughly. Then when the war ends, we shall have at hand a mass of facts of great value as a guide in quickly passing a tariff bill, if a revised tariff is not placed upon the statute books before peace is declared.—Iron Trade Review.

NEW FACTORY INSPECTION REGULATIONS.

THE twenty-seventh annual report of the Factories Inspection Branch of the Ontario Department of Agriculture has been issued. It shows that 10,059 inspections of factories and shops were made during the year in 410 cities, towns and villages. The number of accidents reported are 1,270 of which 52 were fatal.

Regulations regarding specifications for fire escapes are given with illustrations, together with a most practical article on how to lessen fire dangers. There are also helpful suggestions regarding ventilation and general sanitation, guarding of machinery, child labor, seats for females in shops, and wearing of girls' hair in mills and factories. Results are also given of the inspection of bake shops, canning factories and evaporators. Special emphasis is placed upon eye protection in certain occupations. In fact "safety first" is urged upon every possible occasion. A most suggestive feature of the report is a series of danger signs in which warnings are given in nearly every foreign language.

Bright Whitewash.—Half a bushel unslaked lime; slake with warm water, cover it during the process to keep the steam; strain the liquid through a fine sieve or strainer; add a peck of salt, the same to be previously well dissolved in warm water; add 3 lb. of ground rice boiled to a thin paste, and stir in boiling hot; add ½ lb. of glue which has been previously dissolved over a slow fire, and add five gallons of hot water to the mixture; stir well, and let it stand for a few days, covering up to keep out dirt. It should be put on hot. One pint of the mixture, properly applied, will cover a square yard. Small brushes are best.

The Design and Constructional Features of Plug Gauges--I.

By C. Hattenberger

The application and maintenance of proper plug gauges for certain lines of manufacture mean greater efficiency and interchangeability. Where a large number of similar pieces are required, suitable gauges are most essential, and should be provided.

PLUG gauges are being used in altogether too few instances, and those who are not familiar with them in inspection work in large plants would hardly dream of the rapidity with which they can be used and the work accurately measured. There are two types of plug gauges—the standard reference plug gauge and the limit plug gauge. Where holes are produced in large quantities the limit plug gauge is to be preferred, because greater interchangeability is secured, and there is an increase in production on certain lines of work. When only a small number of holes are to be measured, it will in some cases suffice to use a temporary gauge made from soft machine steel. For small gauges up to one inch in diameter, tool steel should be used, and for the larger sizes a good quality of machine steel, suitably case-hardened, answers the purpose admirably.

It is good practice to allow the gauge to season before grinding it to size. For most manufacturing purposes lapping is not necessary; a gauge from the grinder should be sufficiently accurate for all practical purposes. Some shops in an endeavor to save expense use soft steel handles and make the measuring part of the gauge of a good quality of high carbon tool steel. This economy is sometimes carried too far; so little material is really saved that the saving on material is more than outweighed by the extra amount of labor required.

A set of standard reference gauges should be kept in the tool-room and used only when checking or making new gauges. A record should be kept of all gauges. Before designing or making a plug gauge, it is essential that the following points are considered:

Reflective Features.

1.—If a standard plug gauge is required, would it be cheaper to buy the gauge?

2.—Is a standard plug gauge or a limit plug gauge best adapted for the work?

3.—If a limit gauge is decided upon, are the limits correctly determined?

4.—Is the gauge to be used on one or more operations?

5.—Can attachments be added to the gauge that will extend its usefulness?

6.—Can the gauge be quickly inserted and removed?

7.—Are all necessary corners rounded?

8.—Is the gauge absolutely foolproof?

9.—Have you specified the material to be used for the various parts?

10.—What parts are to be hardened?

11.—Is the gauge awkward to handle?

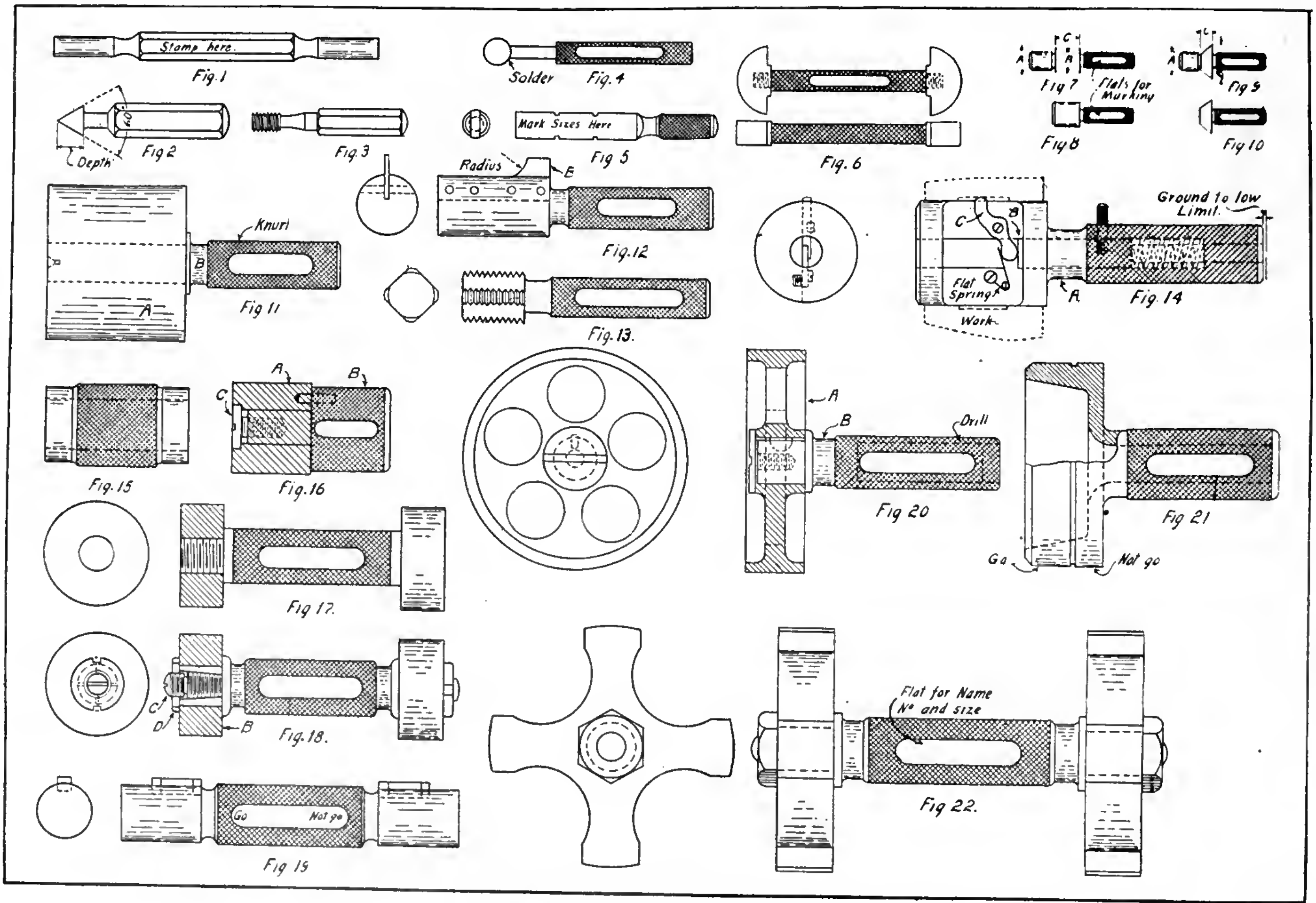
12.—If the gauge is too heavy, can it be lightened by changing the design?

13.—Is it cheaper to make a separate handle of soft machine steel?

14.—Can the handle be used on more than one gauge?

15.—Would a hollow handle be best?

16.—The handle should be knurled, if possible, and a flat provided for stamp-



DESIGN AND CONSTRUCTIONAL FEATURES OF PLUG GAUGES.

ing the name, number, and size of the gauge. Have you specified this in the drawing?

17.—Chamfer the ends of straight plug gauges slightly to insure easy entering.

18.—If the gauge is to be used in a blind hole, provide an air vent.

19.—Provide dirt grooves on thread plug gauges.

20.—Don't fail to remember that a highly-finished thread gives the best wearing qualities.

21.—If a taper hole is to be measured, can you use a plain or an indicating taper plug gauge?

22.—If an indicating gauge is decided upon, are the graduations spaced far enough apart so they can be plainly seen?

23.—If the hole is a large one, can a pin or rod gauge be used to better advantage?

Although plug gauges are most frequently used for measuring holes, their use can be extended considerably, as will be shown in the illustrations.

Small Plug Gauge.

Fig. 1 shows a limit plug gauge very much in use in typewriter, sewing machine and gun factories. It is usually made from bar tool steel of either hexagon or octagon shape. When large quantities of these gauges are used, it is very often the practice to turn and centre them in a hand-screw machine, and after being hardened they are finished in a cylindrical grinder. The reason for using steel of the shapes mentioned is to afford a firm grip for the hand and save the expense of knurling.

Centre Gauge.

The gauge shown in Fig. 2 is used to measure the depth of centres in the ends of shafts, etc.

Thread Plug Gauge.

In Fig. 3 is shown a thread plug gauge that can be used to advantage on small tapped holes. The threads should be left about .001 of an inch large; then after hardening they can be finished with a cast iron or copper lap charged with fine flour of emery or diamond dust.

For Small Holes.

For measuring small holes requiring great accuracy the gauge shown in Fig. 4 answers the purpose. It consists of a standard steel ball soldered to a machine steel handle. Only solder of a low melting point should be used. Points in favor of this type gauge are that no care is required to start the gauge straight, as is the case with a cylindrical gauge, and, if a ball shows signs of wear, it can be quickly replaced at small expense.

Fig. 5 is a limit gauge for measuring small holes. Two flats are milled to lighten it and provide a smaller measuring surface, a feature which is very often desired. The sizes are minimum and maximum on the ends and exact size in the centre.

Keyway Gauge.

In Fig. 6 is shown a Woodruff keyway limit gauge, consisting of a soft steel handle, having threaded ends, to which are fitted the measuring blocks. A gauge of this kind checks the width and depth of the keyway.

For Fillister Head Screws.

Figs. 7 and 8 show gauges used in gauging the size drill and counterbore of fillister head screws, A representing the body diameter of a fillister head screw, B the diameter of the head, C the length of head or depth of counterbore.

For Countersink Screws.

Figs. 9 and 10 show gauges used in gauging the size, drill and countersink for flat head machine screws; A represents the body diameter of a screw; B is the diameter, and C the length of the head. The angle of the head being 70 degrees, included angle.

Large Plug Gauge.

The amount of tool steel entering into the construction of the larger size plug gauges is no small item. Any scheme that will effect a saving in this direction is worthy of consideration. Fig. 11 shows how this may be done. The tool steel ring A is bored to about .002 of an inch smaller than the shank of handle B, which is made of soft machine steel. After the ring A has been hardened, it should be immersed in boiling water and allowed to expand. The handle can now be inserted into the hole without difficulty. After cooling, the ring will be securely held on the handle. It may now be ground to size, using centres provided for that purpose in the handle. When the gauge has become worn, it can be removed, annealed, and used for the next size smaller.

Radius Gauge.

An efficient means for measuring the radius at the mouth of a hole is found in the gauge shown in Fig. 12. It consists of a plain plug gauge, having a slot to which is fitted the hardened steel piece B, having the correct radius. This is firmly secured by means of the dowel pins shown in the illustration.

Relieved Thread Plug Gauge.

A feature that will be found of value in connection with thread plug gauges is shown in Fig. 13. Four flats are milled to provide space for oil and chips. Holes tapped in cast iron retain considerable oil and chips. Under conditions of this kind gauges of this type are the only kind that can be used to advantage.

Recess Gauge.

The gauge illustrated in Fig. 14 is used for gauging the depth of a recess. The plunger B is held against a bell crank, C by the action of a spring, on the end of the handle, A is ground a step that shows the limit within which the work must be machined. The end of the plunger is required to come within the step when applied to the work. A small knurled handle is provided to facilitate the entry and removal of the gauge.

Short Limit Gauge.

On turret lathes the space between the tools and the work is often very limited. For such conditions the double-ended limit gauge shown in Fig. 15 was designed. It will be noticed that its length is short compared to the diameter. A hole extends through the gauge for the purpose of reducing its weight.

Convertible Plug Gauge.

Another gauge designed for turret lathe use is shown in Fig. 16. It consists of a hardened and ground ring A, having a hole its entire length and counterbored to receive the screw C. The handle is made of machine steel, and carries a pin, D, which prevents part A from turning. Additional rings of various sizes can be made to fit the same handle, thereby reducing costs appreciably.

Built up Limit Gauges.

Fig. 17 shows a simple method of constructing a double-ended limit gauge. Two hardened steel discs are screwed on the threaded ends of a machine steel handle.

The form of gauge shown in Fig. 18 costs more to manufacture, and possesses no advantages that would warrant its adoption in preference to the gauge just described. Referring to the illustration, it will be seen that the ends of the handle A are threaded taper to receive the expansion screws, C; these are held in place by the lock nuts, D. The measuring discs B are made of tool steel or machine steel suitably carbonized.

Keyway Testing Gauge.

Fig. 19 is a gauge used for testing the proper location of keyways. Each end is a plain plug, to which is fitted a ground steel key, having the proper limit, and secured by screws or solder. All parts should be hardened.

Extra Large Gauges.

When a plug gauge gets over 3½ inches in diameter, weight is a factor to be considered, and calls for alteration in the design. An example is shown in Fig. 20. The measuring disc (A) is grooved out on the faces, and five holes provided, as will be seen in the illustration. The handle (B) is held by means of the key and screw shown.

Single End Limit Gauge.

A good example of a single end limit gauge is shown in Fig. 21.

Relieved Limit Gauge.

Another form of limit gauge is illustrated in Fig 22. This type can be laid on the machine or bench without rolling off. The discs are secured by means of a nut screwed on each end of the handle.

REFINEMENTS IN MECHANICAL DRAWING.

By James E. Cooley.

THE symbols and conventional methods used in mechanical drawing have been so long established that drawings as a rule have undergone very little change and improvement compared with other systems and practices relating to the machine industry. The most of us are familiar with an advertising phrase that runs something like this: "We could not improve the goods, so we improved the package." This may not have a direct application to a drawing, but it serves to show that while a limit may be reached in improving a certain article, it is possible to go a point beyond and refine something in connection with it. This is true of mechanical drawings, machinery, or even man himself.

Refinement of Individual Detail.

A doctor may be a first-class surgeon, by his skill and ability may have reached a high mark in his profession, but, beyond his skill and ability, though he may go no further, it is possible for him to refine his methods in the handling of his cases or whatever relates to his respective calling. Such is true of the draftsman and the drawings he makes; he cannot perhaps improve the symbols or methods in use, but it is possible to refine the arrangement of these so that his drawings will have a neater and better appearance.

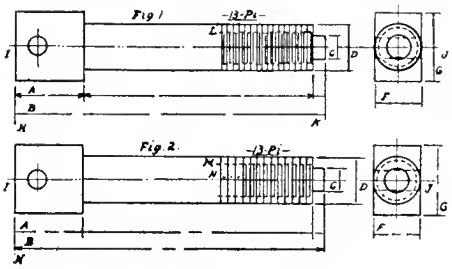
Omissions and inaccuracies are to be noted more or less on mechanical drawings, but it is not to be assumed by this that the average draftsman is careless. In many cases he is a hurried individual, produces work that has a hurried appearance, he is subject to others "higher up," and not allowed time to produce drawings with any semblance of finish or neatness of execution.

Drawings a Necessary Evil?

An impression has gone forth and has gained widespread publicity that drawings are a "necessary evil." Nothing is further from the truth and sense in a report of this kind. That which is vitally important as an aid in producing work accurately and economically cannot be an evil. The evil would be in trying to machine or fit a piece of work without the aid of a drawing. It is poor economy to rush or try to cheapen work in the drawing-room in order to save time and expense in this particular branch of the machine tool industry. It is not uncommon to see drawings, such as pencilings, taken direct from the drawing board and used, with edges untrimmed, having no border lines, superfluous lines unerased, or even blueprints in use that have not been given proper time for exposure, the color being so mottled that the lines and figures are hardly readable. On this principle of doing work, one might assume that the machine work was being produced in the same manner or on the same scale.

Average Drawing Imperfect.

However, it can be said with truthfulness that no matter how much pains have been taken, the average drawing is a poorly executed affair. This may not be discernible to the user, it may not be noticed even by draftsmen, but it can be shown on examining any drawing that the proper finish as regards symmetry, or the proper placing of certain lines, figures, etc., in their relation to each other has not been or never is given any consideration. The two views of a special stud, Figs. 1 and 2 that accompany this article, show clearly a few important points either unknown or overlooked by draftsmen and others, but which if kept in mind and practised would add



REFINEMENTS OF MECHANICAL DRAWING.

considerably to the general appearance of a drawing.

The first to be mentioned are the dimension lines. These are usually placed on drawings with little attention to order or arrangement. Note the lines A-B, Fig. 1, unevenly spaced from the stud-head. See same lines in Fig. 2, placed an equal distance apart. Note again the lines C-D, Fig. 1, between the end of the stud and side of stud-head, and the same lines below evenly placed across this space. Also see lines F-G, Fig. 1, denoting thickness of head; these are badly spaced. How much neater they appear as placed in the figure below. A fault common to many draftsmen is to draw witness lines one longer than the other at each end of a dimension line, as seen at H-K, Fig. 1, also in several other places in this figure. All the witness lines in Fig. 2 overhang equally from the dimension lines.

Centre lines as usually drawn have a hit-and-miss appearance, because the lengths of the dash lines are seldom alike. It is also noticed that the ends of the line as at I and J, Fig. 1, terminate unequally from the views. In Fig. 2, this centre line is evenly spaced, both in the dash and dot, and terminates alike at the end of the two views through which it passes.

It might be said here that, ordinarily, draftsmen cannot take the time to put all these finer touches to a drawing. It does not require any extra time; it is done with the eye, by practice and by taking pains. It is simply the difference in being methodical in one's work or slipshod.

Attention is further directed to making arrow-heads. These should be slightly curved and darkened so they will show up plain on a blueprint. Those often shown, as in Fig. 1, resemble a "pick-axe" as much as they do an arrow-head.

Screw Threads.

Lines representing threads should be spaced off with dividers, because the number of threads per inch are either exceeded, or not enough are shown when guessed at with the eye. The lines showing the depth of thread are as a rule drawn uneven, which appear zig-zag as indicated by the dotted lines L, Fig. 1. It is an easy matter to draw two pencil lines as M, Fig. 2, and make all these thread lines equal lengths, giving the drawing a much neater appearance. Small dots made with the pencil as suggested at N, Fig. 2, will aid the draftsman in drawing these inner thread lines central between the outer thread lines.

Enough has been said here to show in a general way what constitutes the making of a first-class drawing, being simply careful attention given to each detail. The inch marks should be an equal distance on all figures, the border lines should be the same thickness on all sides, the drawing should be evenly trimmed off on the edges, and so on. Such painstaking care will show its mark where careful attention is given to the smallest of these details, and will add wonderfully to the neatness and general appearance of a drawing, all of which may be rightly called refinements.

When a handful of rags, paper, cotton or wool are soaked with oil or varnish (especially drying oils) and are thrown in some place where they cannot get much air, they may be expected to take fire sooner or later. A little dampness makes them take fire quicker. They make heat by themselves. The heat gets greater, little by little, and the more porous the stuff the oil is on, the greater the surface of oil exposed to the air, if the amount of oil is not large enough to fill the pores completely. If there is sawdust around, probability of fire is increased. Why these harmless looking oily rags should take fire by themselves is something that only chemists can explain. It does not matter how this strange thing happens, but it does happen, and that is all we need to know for our purposes. The thing is to get rid of the rags, and not throw them in corners or under machinery.

The Successful Production of Large Steel Castings

Staff Article

The development of certain branches of mechanical and electrical engineering during the last decade has compelled foundrymen to strain every effort in order to keep pace with the ever-increasing demands of machine builders. A careful perusal of the following article will show that Canada is maintaining a satisfactory position in the production of large steel castings, such as are required to meet the most exacting conditions both in size and quality.

THE difficulties of making steel castings increase very rapidly after the weight and size pass a certain limit. Extra heavy castings such as are described in this article call for more than ordinary shop equipment, special shipping facilities and very often great ingenuity on the part of the foundry staff.

Castings such as are described in this article are being continually produced at the plant of The Canadian Steel Foundries, Longue Pointe, Montreal. Fig. 1 shows a large cast steel roughing roll of about eight tons and similar to those used in the largest steel mills. Let us follow the different stages of manufacture through which this piece passes beginning at the pattern shop, the various processes encountered in the foundry, until it leaves the finishing lathe and is ready for shipment.

Moulding a Large Roll.

For a more ready understanding of the method of forming the mould it is better to give first a description of the flask.

In this case the latter consists of two halves of a cylinder made of cast steel, two inch wall thickness, reinforced by circumferential flanges and longitudinal ribs of the same dimension. Each half of the flask is built up in short sections bolted together which make them adaptable to the making of long or short rolls as the occasion demands. On one end of each half is bolted a semi-circular steel plate forming the bottom; the metal is poured in at the other end with the flask standing in an upright position. The lower half of flask, known as the drag, consists of a quarter of a circle plus a square, the side of which is equal to the radius of the cylinder. This is done in order to give a bearing to the flask on the floor. In the corner of this square is also placed the riser or aperture through which the metal rises and enables the operator to tell when the mould is filled, it being impossible to detect same through the filling gate.

Specially Prepared Sand.

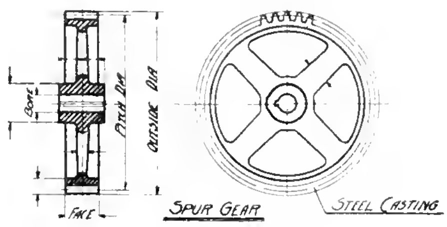
The next consideration is the sand. It is not to our purpose to enter into an analysis of the sand, so called, which consists of a mixture of special earth, gluten, fire clay, molasses, and other ingredients, furthermore than to say that the object sought after is to obtain a homogeneous and compact mass in the mould. Each foundry has its own practice which amounts almost to a trade secret. The prepared sand is then shovelled into the lower half of the flask and we now come to the most important part of the operation, that is, the forming of the mould proper. For the fashioning of the shape of the roll in the sand no pattern is used; instead a long one inch board, shaped out very much like a ratchet, is employed. There are two hinges on this board, which swings on a horizontal shaft, which has its bearing at either end of the flask. This board, commonly called a sweep, is revolved on its axis in the sand, the teeth on the board forming the ridges on the roll and the spaces between the teeth giving shape to the hollowed out sections on the casting. This method is rapid, and does away with the making of an expensive pattern, which in this case would not only prove unwieldy in handling, but also very liable to breakage. The upper half of the flask or cope, as it is called, is made in the same manner as the drag.

The flask with contained mould is lifted by a crane and carried across to an oven car, on which it is subjected to a surface treatment before it is baked. This treatment consists in painting the mould with a heavy solution of molasses and water. The two halves are then placed in the oven for a thorough baking. The resultant mould must be much harder and more solid than for cast iron. The time taken for the baking process is twelve hours, after which twenty-four hours are allowed for cooling off. The drag and cope are now firmly bolted together and stood on end ready for the pouring of the molten metal. The foundry is equipped with two 30-ton furnaces of the acid open-hearth type. For firing purposes ordinary fuel oil, under a pressure of 80 lbs. per sq. in. and air at 100 lbs. per sq. in. are fed into the furnaces. Five hours are required to melt a charge with a consumption of about 35 gallons of fuel oil per ton of metal. A 40-ton bottom pouring ladle is used, into which the entire charge from the furnace is run.

DATE ____________

CANADIAN STEEL FOUNDRIES, LIMITED,
MONTREAL.

Please furnish us with the following dimensions in connection to YOUR ORDER No ____________
OUR ORDER No ____________



SHOW FINISHED DIMENSIONS ONLY

OUTSIDE DIAMETER ____________
FACE ____________
BORE ____________
TOOTH PITCH ____________
NUMBER OF TEETH CAST ____________
PITCH DIAMETER ____________
NUMBER OF ARMS ____________
LENGTH OF HUB ____________
WIDTH & DEPTH OF KEYWAY ____________
ANNEALED ____________
REMARKS ____________

FIG. 2.—PARTICULARS REQUIRED FOR MACHINE MOULDED GEARS.

FIG. 1.—CAST STEEL ROLL. WEIGHT 8 TONS.

Pouring the Metal.

The ladle, of the bottom pouring type, is made from heavy boiler plate lined with fire-brick. A graphite plug of truncated conical shape is used as a stopper for the pouring hole; this plug is connected to a rod which runs through the molten metal, and is insulated from the latter by means of fire-brick discs. The opening and closing is operated by means of a lever attached to the side of the ladle. The life of a graphite plug is considerable, one lasting sometimes for a week. The mould is now poured by one of the foundry cranes carrying the 40-ton bottom pouring ladle, spoken of above, and slowly filled from one end. This operation takes about four minutes. The three or four feet of the roll, which is excess metal, causes a uniform liquid pressure to be exerted full length of the casting and tends to counteract the contraction of the metal while setting. This extra metal is technically known as the crop and runs about 40 per cent. of the total weight of the casting.

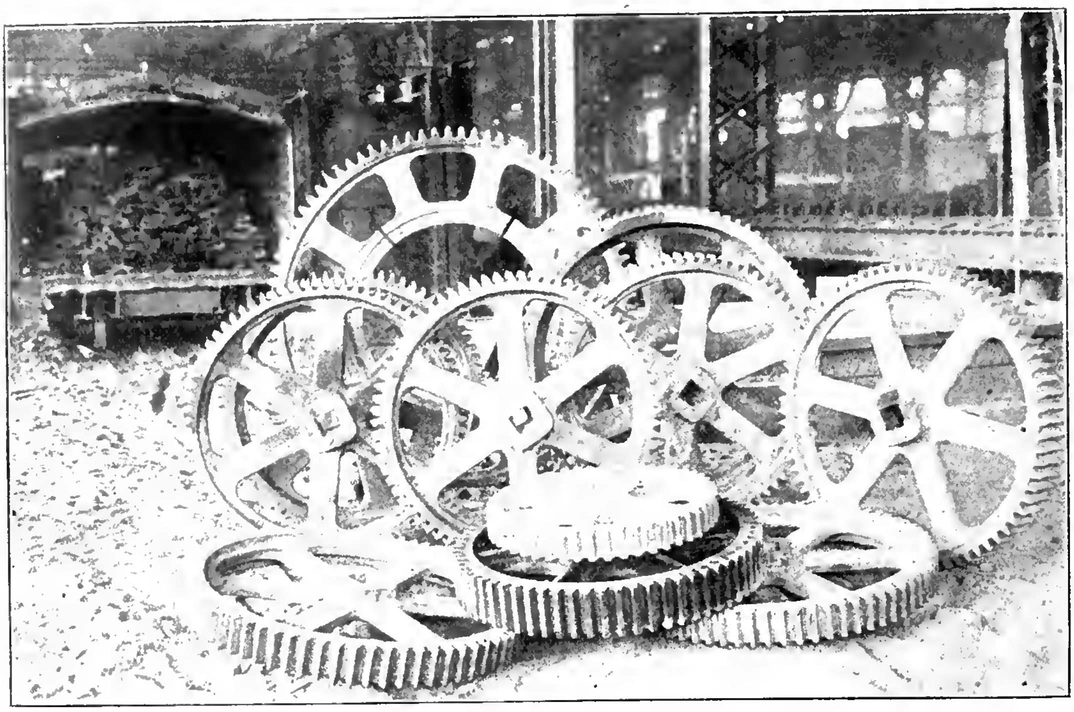


FIG. 3. MACHINE MOULDED GEARS.

The casting is allowed to remain 24 hours in the mould, after which it is removed to the annealing oven. The latter is a long shallow pit, temporarily arched over with brick-work during heats. The rolls are here subjected to a temperature of 900° F. for about 12 hours. They are then allowed 24 hours in which to cool off. This annealing process produces a uniformly soft casting, at the same

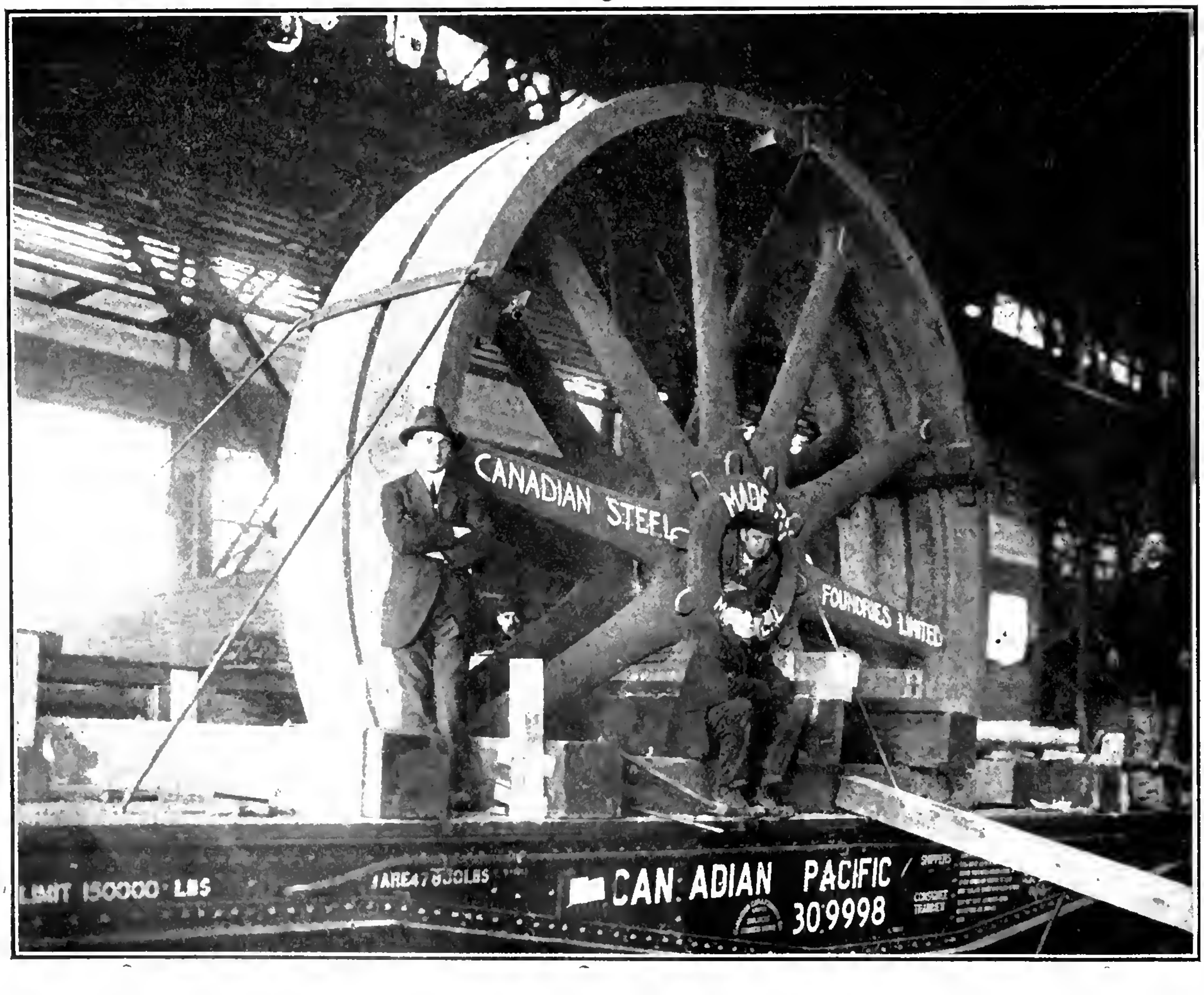


FIG. 5. LARGE STEEL CASTING FOR ELECTRICAL MACHINERY. WEIGHT 19 TONS.

time removing the chill strains set up by unequal rates of cooling. In Fig. 1 it will be noticed that the ends of the roll just outside the bearings are grooved; there are three of these circular slots on each end, their purpose being to engage with three internal teeth of a short sleeve, and act as a flexible coupling or universal joint. The wobbler is moulded only on one end, and has to be machined on the other after the riser or crop, spoken of above, has been cut off. The cutting off process is rapidly performed by means of the oxy-acetylene blow torch. The roll is finally turned down to size on a lathe, and is ready for use.

Machine-Moulded Gears.

In the past few years there have been great strides made in the moulding of steel gears without the necessity of expensive patterns. This is a fact that is not as widely known to the manufacturer as it might be, and one that will often obviate the necessity of a long and tiresome shut-down. The only information required is such as is specified on the form shown in Fig. 2. To such perfection has the machine moulding gear machine been brought that very often a gear can be made and shipped before a pattern could be completed.

Fig. 3 shows a few gears made by the machine-moulding process, and Fig. 4 shows the method of moulding. When sufficient care is exercised in making up the tooth block, the gears will be found to be remarkably true and machining will not be required. The tooth-block usually contains two teeth of the same pitch and dimensions as those on the gear to be moulded. Sometimes more than two teeth are used, but as the time is mostly taken up in the ramming and scarcely any in drawing the tooth-block and revolving the machine, it is not of any material advantage to employ more than two teeth. Moreover, when using a block of two teeth only, a slight alteration in the diameter of the gear can be made, since the "tooth space" only is used, so that the same block can be employed to make a pitch full or bare, which is decidedly convenient in jobbing and repair work. Gears can also be made having one or two teeth, more or less, than the number in the gear for

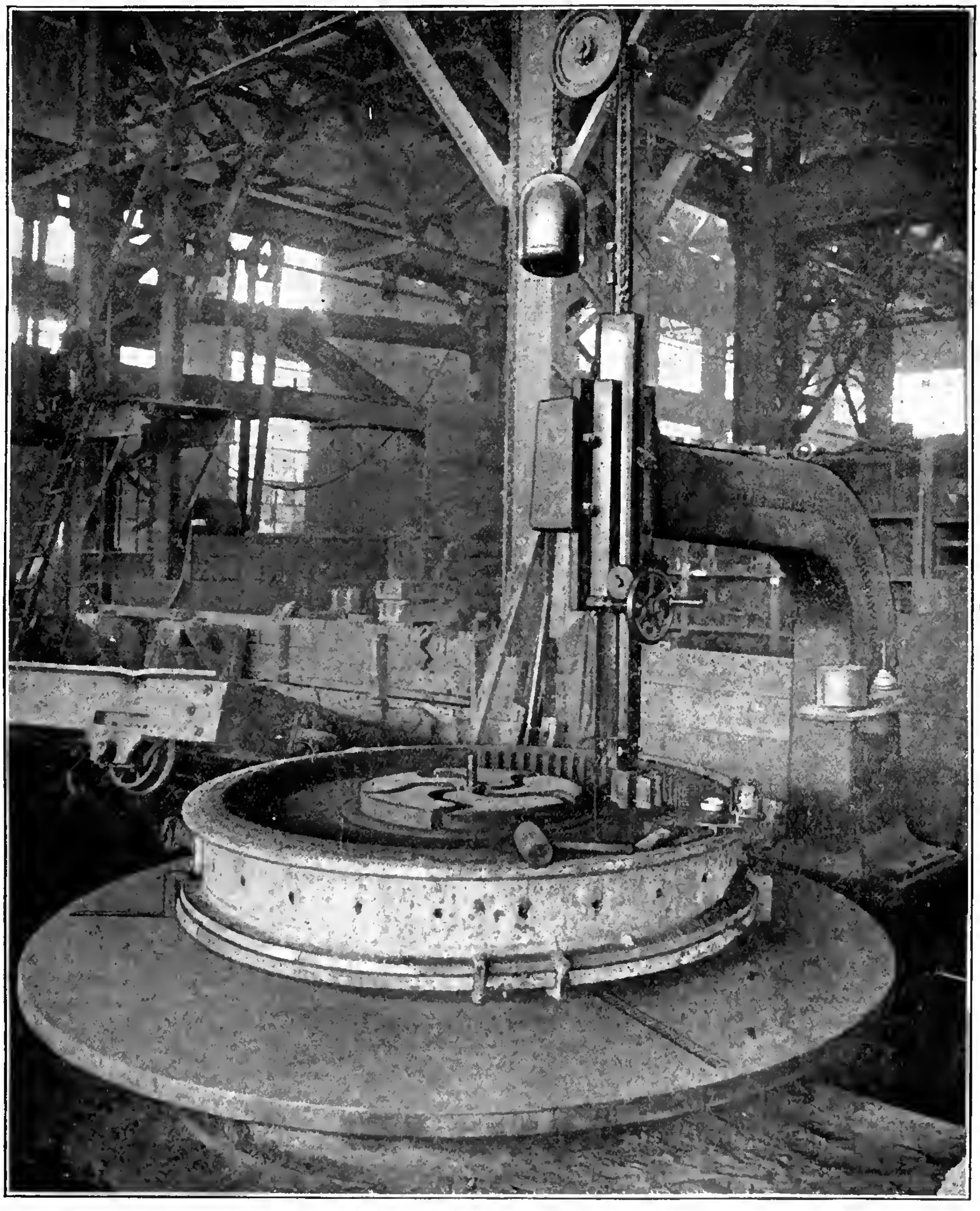


FIG. 4. MOULDING MACHINE PRODUCING MOULD FOR LARGE GEAR WHEEL.

which the block was originally made. Fig. 5 shows a good example of a large steel spider intended for high speed, heavy duty, electrical equipment, which must necessarily be free from defects of all kinds. An idea of the size of the spider may be gained by comparing the bore (in which one of the men is resting) with the height. It is 16 ft. 6 in. diameter, with a 42-in. face, and weighs 37,930 lbs. There is a clearance of just six inches between the bottom of the spider and the railroad track. Note the clearly-defined bolt bosses and clean outlines of arms and rim. The forming of the mould is somewhat similar to that employed in the case of the roughing roll. In that case a sweep was employed, which revolved in a vertical plane around a horizontal axis, whereas in the case of the spider the sweep is revolved in a horizontal plane around a vertical axis pivoted at the centre or hub. The spaces between the arms are cored out and a riser placed on each arm. The molten metal is poured at the hub. The mould baking and annealing processes are somewhat similar to those employed as described above. Fig. 6 shows an extra heavy steel casting, as used in the piers of the Quebec Bridge. This piece was made from what is known as a skeleton pattern, merely a rough box, the main difficulty being the coring of the holes shown in the photograph.

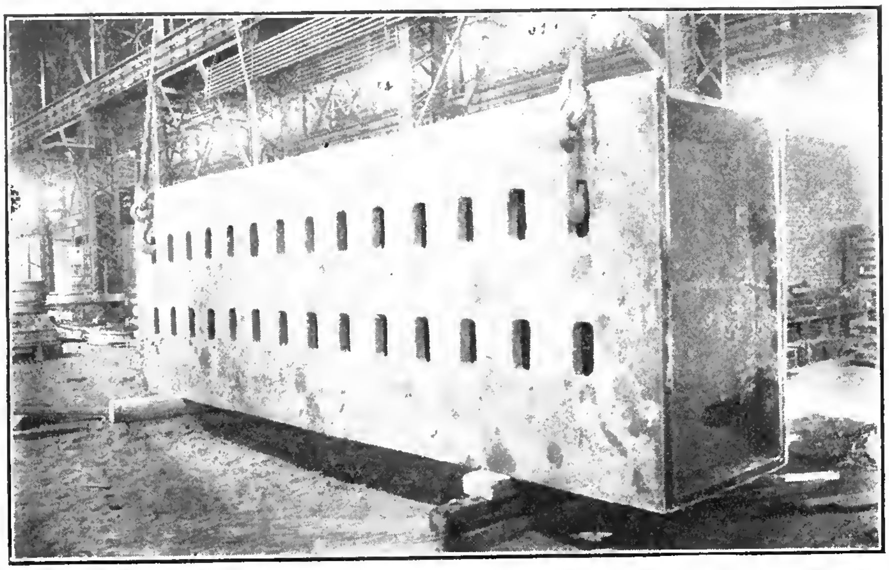


FIG. 6.—STEEL CASTING TO FORM PART OF BRIDGE PIER.

NOISY GEARS.

THE question of noisy gears being always an acute one amongst automobile and machine tool manufacturers, the writer recently sought to confer a benefit upon humanity by trying to discover the prime cause of the trouble. After some thought it seemed that the most natural way would be to study the question from an acoustic point of view. The fact that a sound was produced by two gears running in mesh was sufficient indication that there was some vibration going on, which was communicated to the ear by the intervening air; to find out how this was produced was the problem.

In the case of a gear box having a number of gears in mesh, the sound could only be characterized as an objectionable noise, but with a single pair of wheels, when they were running sufficiently fast to produce a definite sound, it was an easy matter for even a moderately trained ear to identify it as a single note on the musical scale. In any case, it must be admitted that a noise is but an unpleasant combination of notes.

For the purpose of argument a theory was therefore formed to account for it, and it was assumed that in the interstices between the teeth in mesh small quantities of air were trapped, and that these were hurled out at sufficient frequency to produce an audible musical note, the general action resembling that of the siren. A series of experiments to test this was carried out in the following manner:—

Experimental Test Data.

A gear of 36 teeth 12 pitch was mounted on a mandrel between centres in a lathe, and on the saddle was fixed a bracket which carried a stud on which another gear was mounted. The number of teeth on this gear does not enter into calculation, as will be seen. The lathe was then started, and the gear on the cross slide moved forward to mesh with the gear driven by the lathe. In this particular case the lathe spindle made 484 turns per minute, and it was observed that whilst the pitch of the note did not alter, the volume of sound considerably increased as the gears were moved closer together. The pitch of the note was then recorded by means of an adjustable tuning fork. The gear wheel having 36 teeth and making 484 turns per minute, it is obvious that the number of teeth passing a given point per second would be:

$$\frac{484 \times 36}{60} = 290$$

That is to say, according to the theory, 290 was the frequency of the note. Now 290 is as nearly as possible D on the standard musical scale, so the next step was to strike D on the piano, and, as was expected, the note was exactly in unison with that of the tuning fork.

The experiment was repeated with different gears and speeds, but with the same result; it was always possible to predict the note by calculation. The converse experiment was also performed in which the spindle speed was accurately calculated from the note. This theory would seem to have some corroboration from the quietness of the herring bone gear, probably due to the interference between two series of wave motions whose wave fronts are inclined at an angle to each other.

Even with a theoretically perfect tooth curve, so long as there were any air spaces, there would still be a certain amount of sound, a conclusion that seems somewhat heretical. Of course in an imperfectly cut gear there is a series of actual impacts and scrapes between the teeth as they come in contact which greatly increases the volume of sound.

Whether the theory be right or wrong, one thing is certain, namely, that the pitch of the note is a simple function of the number of teeth passing a given point per second, and that there is a distinct connection between each tooth and each vibration.

The experiments are probably interesting only from an academic point of view, as without a remedy they are valueless, but still, they are offered here as suggesting a comparatively new line of thought.

So far only one practical application has been suggested, and that came from a rabid motorphobe friend of the writer. It was, that all automobile makers should be compelled by law to fit their cars with gears of uniform pitch and ratio, the police being musically trained and armed with tuning forks. Excessive speed could then be easily detected by the preceding method.—Herbert's Monthly.

G. R. G. Conway, until recently chief engineer of the British Columbia Electric Railway Co., Vancouver, B. C., will establish an office as consulting engineer at Toronto, Ont.

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

NEW CONSTANT SPEED DRIVE PLAIN GRINDING MACHINE.

ANOTHER addition to the already extensive line of single pulley constant speed drive machine tools, built by the Brown & Sharpe Mfg. Co., Providence, R.I., is shown by Figs. 1 and 2, which illustrate their new No. 11 plain grinding machine, which has a capacity for work up to 32 inches length and 6 inches diameter.

The usual advantages of a self-contained drive, such as elimination of complicated overhead works, a wider selection of speeds and feeds, better adaptation to a motor drive, etc., are all to be found in this new design. The method of application is particularly interesting, as it brings out some new ideas in the design of drive for different parts of the machine.

Power is transmitted to the machine through a main driving shaft running in two large taper roller bearings bolted to the rear of the machine. This shaft, running 900 r.p.m., is driven with a 3-in. belt from a simple counter-shaft, containing one tight and loose pulley and one driving pulley to a large pulley located on the end of the main driving shaft, as seen in Figs. 1 and 2. A large pulley located centrally between the two roller bearings on the main driving shaft drives the wheel spindle, with a pulleys run on taper roller bearings, supported in a heavy swinging bracket so constructed as to follow the transverse movement of the wheel-stand, thus keeping the desired tension upon the driving belt, regardless of the position of the grinding wheel, and insuring accurate feeding of the wheel under all conditions. The slack in the belt, due to the difference in diameter of the wheel spindle pulleys when changes in wheel speeds are made, is taken care of by the top idler pulley, which is provided with separate adjustment, making it possible for the operator to place any desired tension on the wheel spindle driving belt. Referring to Fig. 2, this drive as well as the head-stock and table traverse drive, may be seen.

The table traverse movement is driven by a sprocket A, Fig. 2, located on the speed case, driving sprocket B being located on the table traverse reversing mechanism, which is self-contained in a case fastened into the bed of the machine from the front. The head-stock is driven from the speed case by a sprocket C to a double sprocket D acting as an idler, to a hardened splined sprocket E. A splined shaft supported in bronze bearings under each end of the work-table, sliding in the splined sprocket E, drives, through a chain and sprockets, a telescopic shaft and universal joints, upon a sprocket running on tapered roller bearings around a fixed spindle, which firmly holds a dead centre in such a manner as to become practically an integral part of the head.

All chain drives throughout this machine are of a silent type, eliminating slippage, but providing the desired flexibility and giving a smooth, steady drive to the work. Easy means of adjustment are provided in all cases. The tapered roller bearings used are of an adjustable type, and are lubricated by means of grease cups.

A very important step in the evolution of this machine was taken a short time ago when a simple and efficient speed and feed change mechanism was developed. The mechanism was briefly described in this paper at the time, but it has such an important bearing on the present self-contained drive that an illustration and outline of its principal points are well worth while.

The drive from the main shaft of the machine to the sprockets in the speed case that drive the head-stock and table is of a powerful multiple friction disc type. It enables the operator to easily start and stop the work or table movements without shock, and gives practically universal choice of independent speeds and feeds.

Fig. 3 shows the interior of the speed

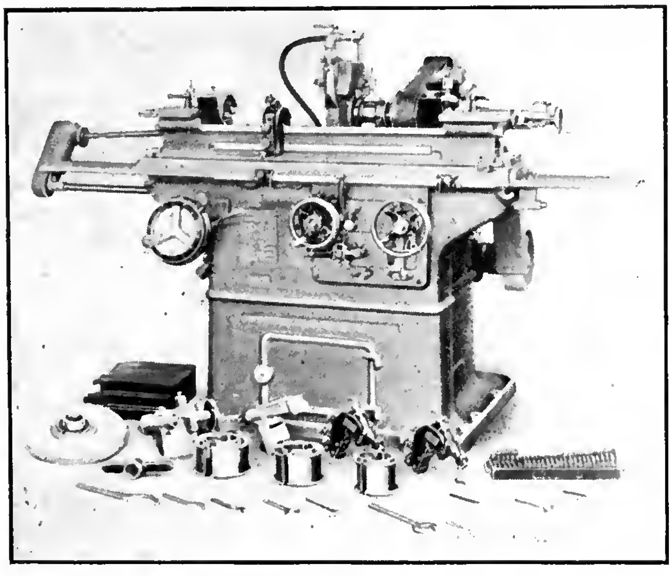


FIG. 1. CONSTANT SPEED DRIVE GRINDING MACHINE.

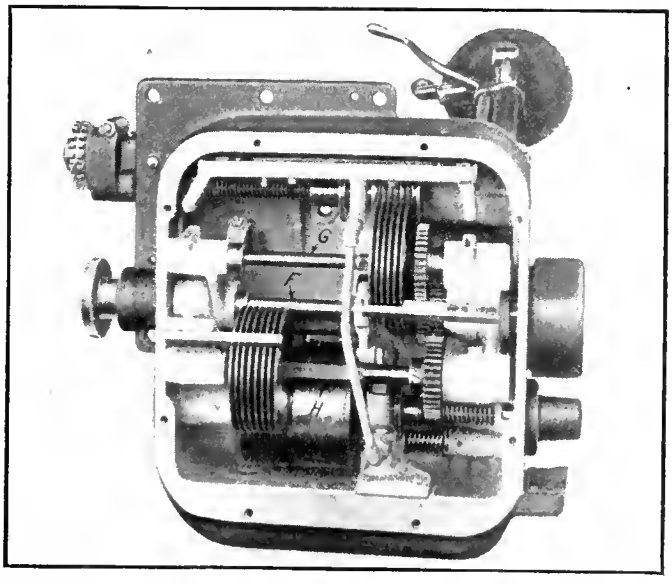


FIG. 3. SPEED CASE FOR CHANGING SPEEDS AND FEEDS.

3-in. belt running over two idler pulleys. Changes in wheel speeds are obtained by means of split pulleys on the wheel spindle that can be quickly interchanged without removing the belt. The idler which in turn transmit power to the head-stock chain. The splined and telescopic shafts are clearly shown at the end of the table in Figs. 1 and 2.

The work driving plate is mounted case, the back having been removed. From the main driving shaft F power is transmitted through gears to two separate driving shafts, G and H, running at a constant speed. These shafts carry

a series of hardened steel discs, ground slightly convex, and each meshing with another series of hardened steel discs. The latter discs have a rim at their periphery, bringing the point of contact always at their extreme edge. The driving shafts are mounted in swinging brackets pivoted on the main driving shafts bearings. They are swung toward or from the driven shafts, carrying the driving discs toward or from the centre of the driven discs, thus obtaining the desired

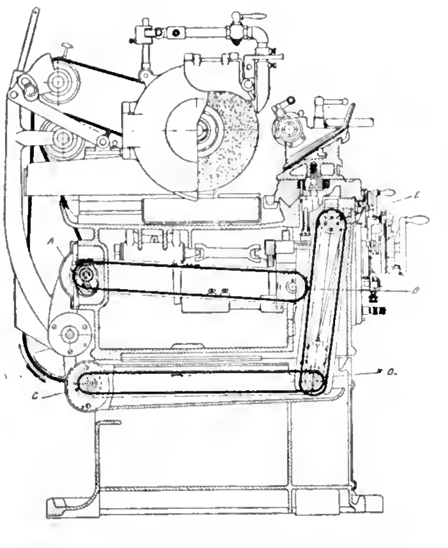


FIG. 2. NEW CONSTANT SPEED DRIVE PLAIN GRINDING MACHINE.

changes in the speed of the work or feed of the table by decreasing or increasing the radius of the driving discs. A continuous flow of oil from a pump direct connected to the main driving shaft furnishes lubricant for the entire case.

The control of the speed case is governed by three levers grouped around a dial mounted at the left of the machine within easy reach of the operator. (See Fig. 1.) The lever marked "Head" controls the head-stock or rotation of the work. Any desired number of revolutions may be obtained, ranging from 82 r.p.m. to 412 r.p.m. A second lever marked "Table" changes the rate of table traverse. The dial is graduated to read in inches per minute. Any desired change from 13 to 181 inches per minute may be obtained. A third and longer lever serves to instantly stop and start both work and table simultaneously without stopping the grinding wheel.

Another new feature found in this machine is the independent automatic cross feed, which enables the wheel to be fed automatically into the work without traversing the table. This feature is especially valuable and efficient when the portion of work to be ground is not as great as the width of the grinding wheel. In feeding the wheel straight in, marked economy in production may be secured. This independent automatic cross feed is driven from the table traverse mechanism, and operates the ratchet arrangement of the regular automatic cross feed. As a result, the full number of changes of feed that can be made with the regular cross-feed mechanism are available. These may be increased or decreased by changing the speed of the table traverse mechanism with the table traverse feed change mechanism, giving practically a universal selection of feeds from the coarsest to finest that are ever required. A positive safety lock is provided to prevent throwing in the table traverse when the independent automatic cross feed is in operation.

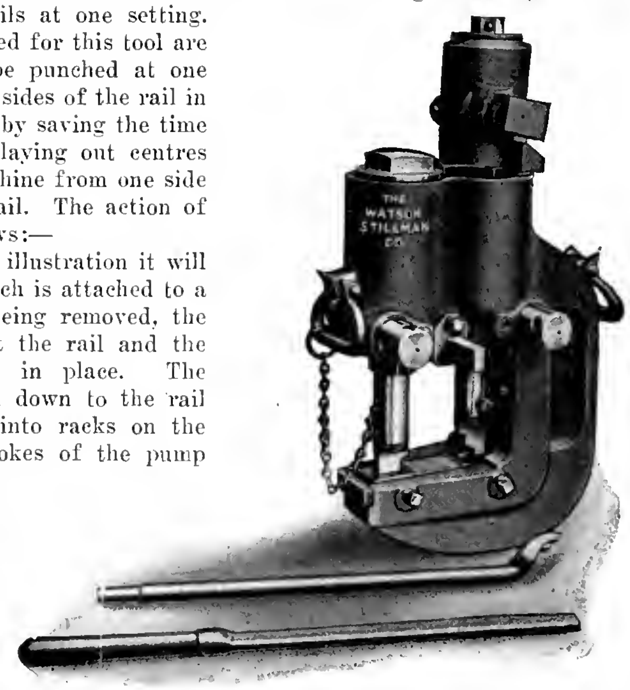
These important features in design in connection with the general heavy, compact and rigid construction, the handy arrangement of operating levers, hand wheels, etc., fit this new machine particularly for the requirements of manufacturers on dead centre work, either straight or taper, within its capacity.

DUPLEX SPIKE SLOT HYDRAULIC PUNCH.

THE Watson-Stillman Co., Aldene, N.J., has brought out a new hydraulic punch for cutting out two spike slots in railroad or conductor rails at one setting. The advantages claimed for this tool are that two holes can be punched at one operation on opposite sides of the rail in exact alignment, thereby saving the time usually consumed in laying out centres and changing the machine from one side to the other of the rail. The action of the punch is as follows:—

By referring to the illustration it will be noted that one punch is attached to a chain. This punch being removed, the tool is placed against the rail and the loose punch inserted in place. The punches are then run down to the rail by pinions, meshing into racks on the rams, and a few strokes of the pump lever completes the operation. The whole action, we understand, takes less than two minutes, and involves little effort.

The punch is compactly built, and is so designed that the greatest strength is obtained with the least possible weight. The working parts are readily accessible for cleaning, and the punches and dies are removable for sharpening, renewal, etc.



DUPLEX SPIKE SLOT HYDRAULIC PUNCH.

TRADE RETURNS WITH GREAT BRITAIN.

THE following are the official figures of trade between Canada and Great Britain in the undermentioned articles during June:

Exports From Canada.

	June, 1915.	June, 1914
Wheat	£1,340,475	£1,116,692
Wheatmeal and flour	338,884	168,701
Barley	......	130,669
Oats	24,675	128,462
Bacon	291,480	100,421
Hams	44,467	31,219
Cheese	466,121	262,200
Canned salmon	109,372	6,810
Canned lobsters	19,006	39,242

Imports to Canada.

Spirits	£ 30,882	£ 53,040
Wool	3,984	3,152
Pig iron	1,791	6,109
Wrought rails	....	1,102
Galv. sheets	21,593	27,629
Tinned plates	5,513	5,227
Steel bars	4,909	13,481
Pig lead	1,024	3,164
Cutlery	5,574	8,252
Hardware	2,394	8,588

The Leon Torpedo.—The form of drifting mine used by the Turks is believed to be the Leon torpedo, which resembles a short Whitehead torpedo. It can be discharged through a torpedo tube or dropped overboard. It is not an automobile torpedo, but a freely-floating mine, which can be set to oscillate between any depths below the surface. The torpedo sinks until automatically the propeller is brought into use and drives it upwards again, when the action of the propeller ceases. There is a time arrangement embodied by which the duration of its floating can be regulated.

The MacLean Publishing Company

LIMITED

(ESTABLISHED 1888)

JOHN BAYNE MACLEAN - - - - - - President
H. T. HUNTER - - - - - - - General Manager
H. V. TYRRELL - - - - - Asst. General Manager

PUBLISHERS OF

CANADIAN MACHINERY
AND MANUFACTURING NEWS

A weekly newspaper devoted to the machinery and manufacturing interests.

PETER BAIN, M.E., Editor.

Associate Editors.
A. G. WEBSTER, J. M. WILSON, J. H. RODGERS,

B. G. NEWTON - - - - - Advertising Manager

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CANADA—

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Toronto—143-153 University Ave. Telephone Main 7324.
Winnipeg—34 Royal Bank Building. Telephone Garry 2313.

UNITED STATES—

New York—R. B. Huestis, 115 Broadway. Phone 8971 Rector.
Chicago—A. H. Byrne, Room 607, 140 South Dearborn St. Telephone Randolph 3234.
Boston—C. L. Morton, Room 733, Old South Bldg. Telephone Main 1024.

GREAT BRITAIN—

London—The MacLean Company of Great Britain, Limited, 88 Fleet Street, E.C. E. J. Dodd, Director. Telephone Central 12960. Address: Atabek, London, England.

SUBSCRIPTION RATES:

Canada, $2.00; United States, $2.50; Great Britain, Australia and other Colonies, 8s. 6d. per year; other countries, $3.00. Advertising rates on request.

Subscribers who are not receiving their paper regularly will confer a favor by letting us know. We should be notified at once of any change in address, giving both old and new.

Vol. XIV. JULY 29, 1915 No. 5

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THE "RETURNS" VALUE OF ADVERTISING.

IN the determination to take advertising space in a publication—domestic, trade or technical, what, we ask, are the considerations on which the decision usually depends? At first sight the query would not only seem to be unnecessary, but bear evidence as well of apparent lack of knowledge of human nature. Without, therefore, giving the slightest thought to the matter, a great majority of those appealed to would unhesitatingly reply that at the very least direct results equivalent to the money spent would be desired and ultimately expected.

There is little of sentiment, it would appear, in advertising, as a consequence there is generally little disposition on the part of the advertiser to either realize that he may or should be a benefactor even to a small extent. The general tendency is, as we have already said, towards direct and sufficient-in-value returns. Scant consideration, if any, is extended to what are known as indirect results, the smack of philanthrophy about these being considered altogether "unhealthy" from a business standpoint.

In spite, however, of the views so generally and tenaciously held, and the persistency with which we endeavor to put them into practice, isn't it true that in spite of what we achieve or otherwise in direct results from our advertising, we actually achieve more in the indirect sense, and become in very fact benefactors—even philanthropists in spite of ourselves

Most manufacturing concerns advertise because it pays them to do so; some don't, because they believe they can do equally well without advertising; others again may or may not advertise because of the fact that their particular product belongs to one of a few selective industries in which, although competition may be and is more or less keen, no possible monetary return is realizable.

Concerning the latter classification and specifically those who advertise—quite a few do so, the action taken may be meant to indicate simply a desire to keep the firm name before the public, a by-no-means unwise proceeding. There is, however, much more involved in such advertising than simply keeping one's name before the public, and just here it seems, that, were nothing else considered, some sensible percentage of every advertising appropriation should be excluded from direct results expectations and be ear-marked "the public eye only."

Advertising of any sort has an educative value, the latter being unrestricted to the mere bringing of buyer and seller together. It has made possible the placing in the hands of the public, at little cost, literature which aids them in every conceivable condition, circumstance and difficulty, and in no sphere is this so fully exemplified as in the arts, crafts and manufactures. Publications relative to each of these are recognized necessities, as only through their medium are the administrative and operative staffs of any particular industry kept in prompt, intimate touch with developments which may affect its welfare either way.

Through the opportunity of becoming a subscriber to a trade or technical journal the operative mechanic adds to his capabilities, and as a result enhances his earning capacity relative to his employer as well as to himself. Under such circumstances then, should not a further and quite husky percentage of every advertising appropriation be excised from the direct returns expectation column of the ledger and be esteemed as indirectly reflected in the increased efficiency and output of the shop. It seems to us that even the most progressive of our manufacturers realize in but small degree, if at all, that advertising appropriations are a most potent factor in the education and training of their employees.

Advertising, in that it places within easy reach of operatives of every class and grade a reputable trade or technical journal periodically and regularly, warrants expression of our conviction that whether systematically, intermittently or never practised, there is need for a complete change of viewpoint. The general attitude relative to it is that of an expenditure chargeable to profit and loss account, whereas, when properly considered and allocated, its service rendered belongs more truly to an expenditure on capital account, and is therefore an asset subject to a regular depreciation percentage only.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

	Montreal.	Toronto.
Grey Forge, Pittsburgh	$13 20	$13 45
Lake Superior, charcoal, Chicago	.....	15 75
Ferro Nickel pig iron (Soo)	.....	25 00
Middlesboro, No. 3	21 00	.....
Carron, special	22 00	.....
Carron, soft	22 00	.....
Cleveland, No. 3	21 00	.....
Clarence, No. 3	21 00	.....
Glengarnock	25 00	.....
Summerlee, No. 1	25 00	.....
Summerlee, No. 3	25 00	.....
Michigan charcoal iron	25 00	.....
Victoria, No. 1	21 00	19 00
Victoria, No. 2X	21 00	19 00
Victoria, No. 2 Plain	21 00	19 00
Hamilton, No. 1	20 00	19 00
Hamilton, No. 2	20 00	19 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	2.20
Steel bars, f.o.b., Toronto	2.20
Common bar iron, f.o.b., Montreal	2.20
Steel bars, f.o.b., Montreal	2.20
Bessemer rails, heavy, at mill	1,25
Steel bars, Pittsburgh	1.25
Twisted reinforcing bars	2.15
Tank plates, Pittsburgh	1.25
Beams and angles, Pittsburgh	1.25
Steel hoops, Pittsburgh	1.30
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.10
Small shapes	2.35
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, 1/4 to 1/2 in., 100 lb.	$2 35	$2 25
Heads, per 100 lb.	2 55	2 45
Tank plates, 3-16 in.	2 60	2 45

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$12 50	$12 50
Copper, crucible	14 50	14 50
Copper, unch-bled, heavy	14 00	14 00
Copper, wire, unch-bled	14 00	14 00
No. 1 machine, compos'n	11 50	12 50
No. 1 compos'n turnings	10 50	9 25
No. 1 wrought iron	6 00	6 00
Heavy melting steel	5 75	6 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings	12 00	12 00
No. 1 brass turnings	10 00	10 00
Heavy lead	4 50	5 00
Tea lead	$ 3 50	$ 3 75
Scrap zinc	12 00	14 00

W. I. PIPE DISCOUNTS.

Following are Toronto jobbers' discounts on pipe in effect June 25, 1915:

	Buttweld Black	Gal.	Lapweld Black	Gal.
Standard				
1/4, 3/8 in.	63	32½	....	....
1/2 in	68	41½	....	....
3/4 to 1½ in.	73	46½	....	....
2 in.	73	46½	69	42½
2½ to 4 in.	73	46½	72	45½
4½, 5, 6 in.	....	....	70	43½
7, 8, 10 in.	....	....	67	40½
X Strong P. E.				
1/4, 3/8 in.	56	32½	....	....
1/2 in.	63	39½	....	....
3/4 to 1½ in.	67	43½	....	....
2, 2½, 3 in.	68	44½	....	....
2 in.	....	....	63	39½
2½ to 4 in.	....	....	63	42½
4½, 5, 6 in.	....	....	66	42½
7, 8 in.	....	....	59	35½
XX Strong P. E.				
1/2 to 2 in.	44	20½	....	....
2½ to 6 in.	....	....	43	19½
7 to 8 in.	....	....	40	16½
Genuine Wrot Iron.				
3/8 in.	57	26½	....	....
1/2 in.	62	35½	....	....
3/4 to 1½ in.	67	40½	....	....
2 in.	67	40½	63	36½
2½, 3 in.	67	40½	66	39½
3½, 4 in.	....	....	66	39½
4½, 5, 6 in.	....	....	63	36½
7, 8 in.	....	....	60	33½

Wrought Nipples.

4 in. and under	77½%
4½ in. and larger	72½%
4 in. and under, running thread	57½%
Standard Couplings.	
4 in. and under	60%
4½ in. and larger	40%

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65%
Sq. Head Set Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45%
Flat & But. Head Cap Screws	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in. N.	70%
Semi-Fin. Nuts up to 1 in.	70%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

METALS.

	Montreal.	Toronto.
Lake copper, carload	$21 00	$21 00
Electrolytic copper	20 75	20 75
Castings, copper	20 50	20 50
Tin	44 00	44 00
Spelter	25 00	25 00
Lead	7 50	7 25
Antimony	40 00	40 00
Aluminum	40 00	40 00

Prices per 100 lbs.

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh	$22 00
Openhearth billets, Pittsburgh	22 00
Forging billets, Pittsburgh	28 00
Wire rods, Pittsburgh	25 50

NAILS AND SPIKES.

Standard steel wire nails, base	$2 40	$2 35
Cut nails	2 50	2 70
Miscellaneous wire nails	75 per cent.	
Pressed spikes, 5/8 diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	75
Stove bolts	80
Plate washers	40
Machine bolts, 3/8 and less	70
Machine bolts, 7-16 and over	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes	4¼c per lb. off
Nuts, Hexagon, all sizes	4¾c per lb. off
Iron rivets	72½ per cent.
Boiler rivets, base, 3/4-in. and larger	$3.25
Structural rivets, as above	3.25
Wood screws, flathead, bright	85, 10, 7½, 10 p.c. off
Wood screws, flathead, Brass	75 p.c. off
Wood screws, flathead, Bronze	70 p.c. off

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong, Sizes Ins.	Price per ft.	D. Ex. Strong, Size Ins.	Price per ft.
1/8 in	$ .05½	1/8 in	$ .12	1/2	$ .32
1/4 in	.06	1/4 in	.07½	3/4	.35
3/8 in	.06	3/8 in	.07½	1	.37
1/2 in	.08½	1/2 in	.11	1¼	.52½
3/4 in	.11½	3/4 in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼ in	.23½	1¼ in	.30	2½	1.37
1½ in	.27½	1½ in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½ in	.58½	2½ in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½ in	.92	3½ in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½ in	1.27	4½ in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.....
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....

COKE AND COAL.

Solvay Foundry Coke	$5.75
Connellsville Foundry Coke	4.85-5.15
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

COLD DRAWN STEEL SHAFTING.

At mill	40%
At warehouse	40%

Discounts off new list. Warehouse price at Montreal and Toronto.

MISCELLANEOUS.

Solder, half-and-half	.26¾
Putty, 100-lb. drums	2.70
Red dry lead, 100-lb. kegs, per cwt.	9.67
Glue, French medal, per lb.	0.18
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.18
Benzine, single bbls., per gal.	0.18
Pure turpentine, single bbls.	0.66
Linseed oil, raw, single bbls.	0.73
Linseed oil, boiled, single bbls.	0.76
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Lead wool, per lb.	0.10
Pure Manila rope	0.16
Transmission rope, Manila	0.19½
Drilling cables, Manila	0.17½
Lard oil, per gal.	0.60

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto 40%

PROOF COIL CHAIN.

¼ inch	$8.00
5-16 inch	5.35
⅜ inch	4.60
7-16 inch	4.30
½ inch	4.05
9-16 inch	4.05
⅝ inch	3.90
¾ inch	3.85
⅞ inch	3.65
1 inch	3.45

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	60
Carbon over 1½ in.	25
High Speed	40
Blacksmith	60
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Centre	25
Pipe Reamers	80

Discounts off standard list.

IRON PIPE FITTINGS.

Canadian malleable, 35 per cent.; cast iron, 60; standard bushings, 60; headers, 60; flanged unions, 60; malleable bushings, 60; nipples, 75; malleable, lipped unions, 65.

TAPES.

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3.50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$3 00	$2 90
Canada plates, dull, 52 sheets	3 25	3 50
Canada Plates, all bright	4 40	4 60
Apollo brand, 10¾ oz. galvanized)	6 40	5 95
Queen's Head, 28 B.W.G.	6 50	6 50
Fleur-de-Lis, 28 B.W.G.	5 75	5 75
Gorbal's Best, No. 28	6 50	6 50
Viking metal, No. 28	6 00	6 00
Colborne Crown, No. 28	5 38	5 30

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$10 00	.....
1¼ in.	10 00	.....
1½ in.	10 00	.....
1¾ in.	10 00	.....
2 in.	10 50	9 20
2¼ in.	12 10	.....
2½ in.	13 05	12 10
3 in.	15 75	12 70
3¼ in.	.....	13 90
3½ in.	20 00	15 00
4 in.	25 50	18 90

Prices per 100 feet, Montreal and Toronto.

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50%
Standard	50 & 10%
Cut leather lacing, No. 1	$1.20
Leather in sides	1.10

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	$9.00
¼ in.	6.25
5-16 in.	4.65
⅜ in.	4.00
7-16 in.	4.00
½ in.	4.00

Prices per 100 lbs.

WASTE.

WHITE.	Cents per lb.
XXX Extra	0 10¼
X Grand	0 09¾
XLCR	0 09¼
X Empire	0 08½
X Press	0 07¾
COLORED.	
Lion	0 07⅛
Standard	0 06⅜
Popular	0 05¾
Keen	0 05¼
WOOL PACKING.	
Arrow	0 16
Axle	0 11
Anvil	0 08
Anchor	0 07
WASHED WIPERS.	
Select White	0 09
Mixed Colored	0 06¼
Dark Colored	0 05¼

This list subject to trade discount for quantity.

BELTING RUBBER.

Standard	50%
Best grades	30%

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Toronto, Ont., July 27, 1915.—There are no developments of any particular importance to note this week. Factories working on war orders continue busy and the hope is freely expressed that more orders for war equipment will be placed in Canada. David A. Thomas, the representative of the Imperial Government, has arrived in Ottawa to confer with the Shell Committee. He will also investigate the capacity of Canadian plants to produce munitions, but not place any orders, this matter being in the hands of the Shell Committee. It is understood that he will visit Toronto and Montreal in due course. The situation in regard to the shell industry is unchanged, but developments may be looked for in a month or six weeks. Those firms, however, who contemplate going into the shell business, are ordering the necessary tools and equipment so as to be ready when new orders are distributed.

Considering the extraordinary conditions prevailing owing to the war, there are many reasons to be satisfied with the present outlook from a purely business standpoint. The crop reports are distinctly encouraging, a gratifying feature at any time, but especially so during such times as these.

The country has benefited considerably by the large amount of money that has been distributed in payment for war

orders. Further, the trade returns for June are decidedly encouraging as they show a large increase in exports and a decline in imports and therefore a more favorable trade balance. There is no reason why this should not continue, in fact there are indications that such will be the case.

Steel Market.

The general situation in the steel trade is much the same as has prevailed during the past few weeks. The heavy demand for steel bars and forgings for shells continues and indications point to a continuance of this condition for some time to come. War orders for other steel products amount to fair tonage in the aggregate, but in ordinary lines there is little of interest to note. There is, however, a fairly optimistic tone in the market based on the hope that foreign business will develop to the ultimate benefit of the steel trade. Merchant business continues quiet and the building trade is not showing any pronounced activity.

There is little change to note in the galvanized sheet situation. There is a tendency to shade prices but some makers are still out of the market on account of the spelter situation. Prices of No. 28 black sheets are firmer, but the demand is light.

Conditions in the steel trade in the States continue to improve, principally on account of export business which continues to expand. The Steel Corporation are operating at about 91 per cent. of the ingot capacity and other concerns are showing a similar activity. Quotations on Bessemer and open hearth steel billets have advanced respectively to $22 and $23 per ton, Pittsburg, while prices of bars, plates and shapes are firm, with a higher tendency.

Pig Iron.

There is little of importance to note in this market. Foundries generally are very quiet and operating at considerably reduced capacity. Quotations are unchanged.

Scrap Metal.

The demand for heavy melting steel is improving and quotations are firmer. Copper and brass scrap continue in good demand and prices are holding firm. Wrought iron and cast iron scrap are quiet. Prices are given in the selected market quotations.

Machine Tools.

Prospective shell manufacturers are sending out inquiries for equipment which are keeping local dealers busy. Makers of machine tools are filled up with orders and deliveries are getting worse rather than better. There is nothing particularly new in the situation but developments may be expected when further orders for shells come to be distributed.

Supplies.

Business continues brisk in machine shop supplies and quotations are holding firm. The long expected advance in leather belting has materialized, the new discounts being as follows: Extra Heavy 50%, and Standard 50 and 10%. Tool steel has already advanced and the situation is serious owing to the scarcity of tungsten. For the same reason an advance in prices of twist drills is expected, there being at the same time a heavy demand. Solder "Half and Half," is weaker and is now quoted at 26¾c per pound. The linseed oil market is unsettled with a variation in prices, but the figure given in the selected market quotations may be taken as a fair average. Lead wool has advanced 1c and is now quoted at 10c per pound.

EQUIPMENT FOR AUSTRALIAN RAILWAYS.

Tender forms, specifications and drawing have been forwarded by D. H. Ross, Trade Commissioner at Melbourne, for equipment required by the Victorian Government railways. These tender forms are open to the inspection of Canadian manufacturers when received at the Department of Trade and Commerce, Ottawa (refer File No. 1435). Particulars of the requirements, together with the date on which the tenders close at Melbourne, are briefly outlined thus:—

29031 — Sept. 15, 1915 — 81 (bogie) cast steel wheel centres.

29031 — Sept. 15, 1915 — 81 (leading and trailing) cast steel wheel centres.

29031 — Sept. 15, 1915 — 41 (driving) cast steel wheel centres.

29031—Sept. 15, 1915—10,000 (van and truck) cast steel wheel centres as per drawings.

The departure of the mails from San Francisco and Vancouver are as follows:—From San Francisco August 18, due Melbourne September 15.

Metals.

General weakness prevails in the metal market this week, antimony being the only metal showing any strength. Tin, copper and spelter have all declined, due to a light demand, while the lead market is stagnant for the same reason. Considering the heavy consumption of copper at the present time, the weakness in the market is rather surprising, but as soon as confidence is restored the market should recover. Solders are all lower on account of the decline in tin. The situation in regard to aluminum is unchanged, supplies are scarce and quotations are nominal. Business locally continues good, the demand for metals for munitions forming the greater proportion of this.

Tin—The tin market continues to decline on account of light demand, this encouraging uncovered buyers to keep out of the market except for absolute requirements. The recent small demand is chiefly caused by the majority of buyers receiving tin on old contracts. Tin has declined 1c locally and is quoted at 44c per pound.

Copper—The market is weak with no improvement in demand. The weakness is perhaps due to the high prices having caused the production to increase to a larger degree than the demand. It is also suggested that the restriction in buying is due to the fact that several concerns who accepted large war orders have not got their plants in operation as soon as was expected. The copper situation is, however, strong, owing to very heavy consumption and the market cannot help but recover. Copper has declined ½c and is quoted at 21c per pound.

Spelter—The situation continues much the same, but the market is weak and lower. The demand has fallen off and some of the producers who had been holding for higher prices appear to be now willing to accept less. The scarcity, however, continues and with a better demand the market would no doubt recover. Local quotations have declined 3c and are nominal at 25c per pound.

Lead—The market is stagnant with a weak undertone. There is a falling off in demand and lead is being offered at a figure below the "Trust" price. Local quotations are unchanged at 7¼c per pound.

Antimony—Although antimony is dull there is a very firm tone in the market. Consumption of the metal is almost entirely limited now to the provision of war requirements which are more likely to increase than diminish. Quotations are unchanged and nominal at 40c per pound.

Aluminum—The market is strong and the situation unchanged. Supplies continue scarce and quotations nominal at 40c per pound.

NEWFOUNDLAND TRADE.

THE transfer to the United States and Canada of a large amount of the trade ordinarily carried on between Newfoundland and Great Britain is one of the results of the war. This arises from the changes in the shipping situation.

The gradual withdrawal of trans-Atlantic steamers from the port of St.

John's because of the transport needs of the British Admiralty and the requirements of British trade has reached a point where only three small steamers are now plying between St. John's and Liverpool. These are freight vessels of the Furness Line, with practically no passenger accommodation.

The latest reduction in the service is the taking off of the Allan Line steamers, which for nearly fifty years have plied between Glasgow, St. John's, Halifax and Philadelphia. These ships, the Mongolian, Carthaginian, Pomeranian and Sardinian, are to be transfered to the route between Montreal and British ports.

Business men have necessarily made new connections in Canada and the United States, and steamers making weekly trips between St. John's, Halifax and New York are laden to the hatches.

BY SEA FROM B.C. TO HUDSON'S BAY.

A NEW chapter in Canadian history has been opened in the successful shipping of a cargo of Douglas fir from British Columbia to Hudson Bay, via the Panama Canal. The timber, which is to be used in the construction of piers and docks at Port Nelson, was sold to the Department of Railways and Canals by Hugh A. Rose, representative of the Canadian Western Lumber Co. A further consignment of lumber is on the way to the Polson Ironworks, Toronto, to be made into masts for a dredge which is being built for use at Port Nelson. Hitherto the lumber used at Hudson Bay has been southern pine from the United States. The cargo was carried by the Government steamer Durley Chine, which was the first boat to carry Douglas fir from one Canadian port to another.

WINDSOR A NOR. NAV. CO. TERMINAL.

THE importance of Windsor, Ont., as a lake port was made further evident on July 22 by the announcement of H. H. Gildersleeve, General Manager of the Northern Navigation Company, that, beginning immediately Windsor and Detroit would become the southern terminal for the company's steamers Noronic, Huronic and Hamonic, which make weekly trips to the Soo, Port Arthur, Fort William and Duluth.

The change of the southern terminal from Sarnia to Detroit and Windsor was brought about by the activities of the Windsor Board of Trade. General Manager Gildersleeve was reached in Montreal where he had gone to make arrangeemnts with Grand Trunk Railroad officials for the use of the Brush street wharf in Detroit. He said the company's steamers would start from Detroit, and after crossing to Windsor would start on their voyages to the north.

ONTARIO'S NICKEL COMMISSION.

FOLLOWING a prolonged controversy arising out of certain charges that nickel from Ontario mines was finding its way through various channels to Germany since the outbreak of hostilities in Europe, the Provincial Government a few days ago, through the Hon. Howard Ferguson, Minister of Forests and Mines, announced the appointment of the following Commission:

George T. Holloway, London, Eng., Chairman.

Willet G. Miller, Provincial Geologist, Toronto.

McGregor Young, K.C., Toronto.

Thomas W. Gibson, Deputy Minister of Mines, Toronto, Secretary.

The Commission is empowered to inquire into the whole nickel situation in Ontario with a view to establishing in the Province an industry that will have the material under observation from the time it leaves the mines to the time it is marketed.

While assurances have been given to the Imperial authorities and the Dominion and Provincial Governments that not an ounce of Ontario's nickel is finding its way into the enemy's hands, Hon. Mr. Ferguson states that the Provincial Government views the situation from a larger standpoint and has instructed the new Commission to ascertain whether it is not possible to complete the refining of nickel ore from the mines of Ontario entirely within the Province without having to ship it to American refineries.

The question of the province receiving an adequate return from its nickel deposits is regarded as of much importance, and on this point the Commission will also advise the Government.

CANADIAN GOVERNMENT PURCHASING COMMISSION.

The following gentlemen constitute the Commission appointed to make all purchases under the Dominion $100,000,000 war appropriation:—George Gault, Winnipeg; Henry Laporte, Montreal; A. E. Kemp, Toronto. Thomas Hilliard is secretary, and the commission headquarters are at Ottawa.

ALLIES PURCHASING AGENTS.

The Trade and Commerce Department, Ottawa, has published the following list of purchasing agents for military purposes for the allied Governments:—

International Purchasing Commission, India House, Kingsway, London, Eng.

British.—Col. A. G. Barton and F. W. Stobart, Ritz Carlton Hotel, Montreal.

French.—Hudson Bay Co., 56 McGill Street, Montreal; Captain Lafoulloux, Hotel Brevort, New York; Direction de l'Intendance Ministere de la Guerre, Bordeaux, France; M. De la Chaume, 28 Broadway, Westminister, London.

Russian.—Messrs. S. Ruperti and Aieksieff, care Military Attache, Russian Embassy, Washington, D.C.

PRINCE RUPERT DRY DOCK.

THE big dry dock at Prince Rupert, constructed by the Grand Trunk Pacific Railway in conjunction with the Dominion Government, is expected to be ready for service by August 1st. The dock, which has cost $2,500,000, consists of three units, with a total capacity of 20,000 tons. There will be two end sections of 5,000 tons each, and a middle section capable of accommodating a 10,000-ton vessel. All the units are interchangeable, and each dock is complete in itself, with pumps and air compressors. By employing the three sections together a 600-ft. steamer can be dealt with.

In addition to the actual dock there are five other features of the plant, namely, the foundry, which will be able to make castings as heavy as 12 tons; a boiler shop for marine repairs as well as for the construction of boilers; a machine shop; a ship shed and carpenters' shop; and a power-house equipped with two large turbo-generators and a 1,500 cu. ft. per min. air compressor. Construction work in connection with the dry dock and its accompanying plant has been under way since the beginning of 1912.

ZINC SITUATION IN CANADA.

THAT there is a scarcity of zinc in Canada is evidenced by the price to which it has advanced, from six cents a pound at the outbreak of the war to from 22 to 25 cents a pound to-day. Copper, the other metal which forms one of the elements of brass, has advanced from only 15 cents a pound to 20 cents a pound. Yellow brass, although better for shell purposes, is not as high-grade as the red brass, and yet, owing to the advanced price of zinc, it is now dearer. Yellow brass contains about 60 per cent. copper and 40 per cent. zinc, with a trifle of lead, and the red brass about 80 to 90

per cent. copper and 10 to 20 per cent. zinc, with a small portion of tin.

The scarcity of zinc is attributed by the manager of one of the firms manufacturing shells as being due to speculation, and he is of the opinion that the supply is now becoming more plentiful. The war breaking out, he believed, caused to a great extent a cornering of the market.

"The high price of zinc has been caused by a scarcity," said the manager of another firm. "There is no denying that, because the United States has been exporting great quantities of it to Europe ever since the war broke out. Before the war Europe was a large exporter of zinc, and despite the duty, Belgium and Germany were able to place their zinc in the United States and compete with the manufactured product in that country."

Owing to the fact that it was never really a paying proposition to mine zinc in Canada, he was asked about mining it now in Canada in order to furnish a supply to meet the demand, but he said that the zinc ore in Canada was of a poor quality. It was coarse and contained many impurities so that he questioned if the establishment of refineries in Canada would produce the quality of zinc out of the ores needed for the manufacture of shells. It was his opinion that before six months zinc would go up to 50 cents a pound.

Trade Gossip

Canada's Trade Balance.—The effect of war munitions exports is being shown in the fact that Canada is now building up a favorable trade balance from month to month. In June the excess of exports over imports was $11,716,000, in May $7,689,678, and in April $300,000, a favorable balance for the quarter of $19,705,678. In the previous quarter there was an adverse balance against this country of about $5,000,000. With the prospect for a heavy balance on the right side this fall, owing to the record crop promised, the outlook in this respect is distinctly favorable.

Steel of Canada Outlook.—In circles close to the Steel Company of Canada, the greatest satisfaction is expressed over the outlook. The company had to take some losses in the first quarter of the calendar year, but these have long since been made up, and it is predicted that the results of this year will be fully up to those of 1913, when the company enjoyed a profitable period. The corporation is turning out 200 tons of finished steel product per day, and this presumably will be increased as soon as the new open hearth steel furnace is finished.

Principles of Laying—Off Cylindrical Intersections---I.

By J. W. Ross

The more or less special nature of the work involved in the making of sheet metal piping has caused many manufacturers to avoid this class of work, with the result that when a job has to be handled, there is frequently considerable unnecessary loss incurred through errors in laying off material. The examples treated by the writer of this article should form a valuable reference to many manufacturers on ordinary as well as special occasions.

THE perspective drawing in Fig. 1 illustrates the intersection of two cylinders of equal diameter. The method of obtaining the mitre line, which is essential to the development of the patterns, is shown in Fig. 2 and 3.

Construction.

To construct this tee, measure off in Fig. 2, H G equal to $2\frac{1}{2}$ inches. At right angles to this line, make H A and G F equal to the diameter of the cylinder, which is 1 inch. Draw the line A B E F parallel and equal to H G. Measure off A B and E F each equal to $\frac{3}{4}$ inch, thus locating the diameter B E, of the intersecting pipe, which is equal to one inch. Raise the perpendiculars B C and E D equal to $\frac{3}{4}$ inch each. Connect C to D, thus completing the elevation view of the "tee" as shown in Fig. 2. To delineate the mitre line, it will be necessary to construct an end elevation view, as shown by Fig. 3.

At a suitable distance from Fig. 2 draw in the centre line G^1 7, Fig. 3, parallel to the line D E, Fig. 2. The points 7^2 G^1, Fig. 3, are located by prolonging the lines A F and H G, Fig 2. With centre X and radius X G^1, Fig. 3, strike the circle 4^2 7^2 10^2 G^2. Draw the line 4^1 10^1, Fig. 3, equal in length, and in line with C D, Fig. 2. Draw the lines 4^1 4^2 and 10^1 10^2, Fig. 3, parallel to the centre line 7^1 G^1. This completes the end elevation view. Project and describe—in a suitable position—the whole plan view, 1 4 7 10, above the cylinder elevation C B E D, Fig. 2. Divide this plan view into a suitable number of equal parts, as shown by the 12 divisions in Fig. 2. From these points draw projection lines —parallel to C B and D E—through the line A F. In Fig. 3 also draw a plan view in its correct relation to the cylinder and divide this into the same number of equal parts as was done in the case of Fig. 2. Project these points—parallel with the centre line 7 G^1—to their intersection of the cylinder 4^2 7^2 10^2 G^2. In Fig. 2 the plan view is numbered from 1 to 12. Similarly the intersecting points of the projection lines are numbered in relation to these numbered points in the plan view. Fig. 3 must also be numbered in relation to Fig. 2. As the view in Fig. 3 is shown by a quarter turn to that of Fig. 2, therefore 1 as shown in Fig. 2 of the plan view will be shown by 1 on the centre line 7 G^1, Fig. 3. The other points being numbered accordingly and in relation to both Figs. 2 and 3. The intersecting points are also numbered in respect to their positions.

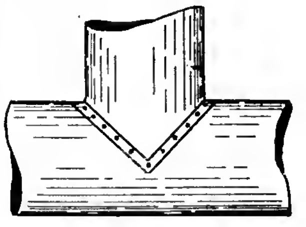


FIG. 1.

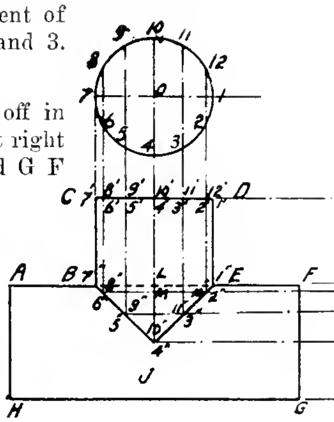


FIG. 2.

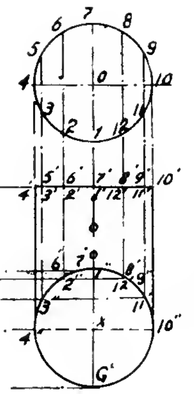


FIG. 3.

The points 4^2 and 10^2, Fig. 3, are projected over to Fig. 2 by drawing a line parallel to the line H G. Where this projection line 4^2 10^2, Fig. 2, intersects the vertical projection line 4^1 4^2, 10^1 10^2, Fig. 2, this locates the extreme point of the mitre line as shown by the letter J and the numbers 4^2 10^2, Fig. 2. Also by drawing lines parallel to J X project over the points 3^2 5^2 6^2 7^2 etc., from Fig. 3 to their intersection of their similarly numbered vertical projection lines in Fig. 2, thus locating the points 7^2 8^2 6^2 etc., Fig. 2. Connect all these points, thus defining the mitre line. Now having obtained the mitre line, the two intersecting pipes may be developed. The straight line D C D, Fig. 4, is made equal in length to the circumference of the cylinder of which D C, Fig. 2, is the diameter. C D, Fig. 2, equals 1 inch, therefore the stretched-out circumference D C D will equal 1 inch multiplied 3.14 = 3.14 inches, which is slightly over $3\frac{1}{8}$ inches.

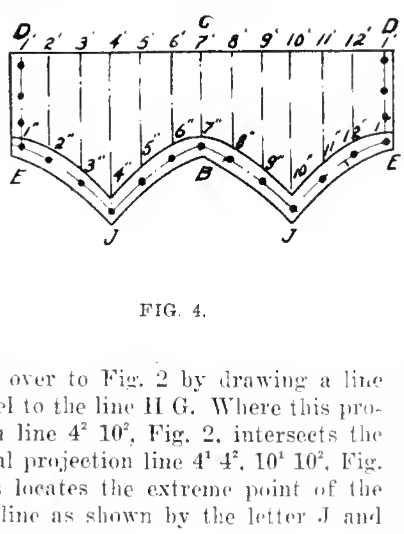


FIG. 4.

Divide D C D, Fig. 4, into the same number of equal parts as in the plan views, Figs. 2 and 3, which is 12. Number these points in consecutive order, with the idea in mind of having the vertical seam to come on the line 1^1 1^2, Figs. 2 and 3. Project lines downward from these points at right angles to D C D, Fig. 4 with the trammels or dividers set at a length equal to 1^1, 1^2, Fig. 3, transfer over to 1^1, 1^2, Fig. 4, this line being the vertical rivet line for this pipe, therefore this distance will be marked off on the extreme division points of the line D C D Fig. 4, as 1^1, 1^2 and 1^1 1^2. Reset the dividers to the distance 2^1 2^2, 6^1 6^2, 8^1 8^2, 12^1 12^2 Fig. 3 which are all equal in this case, and transfer over to their proper positions in Fig. 4.

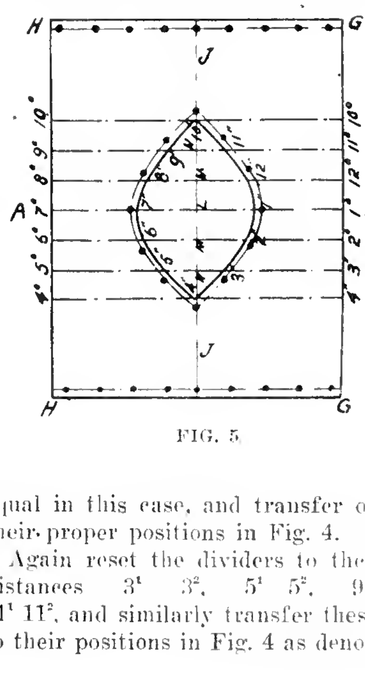


FIG. 5.

Again reset the dividers to the equal distances 3^1 3^2, 5^1 5^2, 9^1 9^2, 11^1 11^2, and similarly transfer these over to their positions in Fig. 4 as denoted by

*Note: The reference letters and numerals in the text, i.e., G^2, 7^2, etc., correspond with those of the illustrations indicated as G'', 7'', etc.

their respective numbers. A fair curve drawn through these located points will denote the mitre line. This mitre line is the flange line for light riveted plate.

The riveted line and laps being afterwards added according to the thickness of the plate and the size of the rivets.

If this tee is made of tin, to be soldered, then the mitre line will be the junction line of the two pipes, soldering

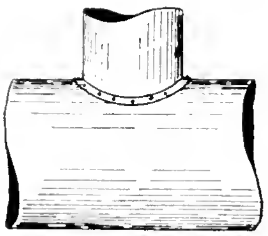


FIG. 6.

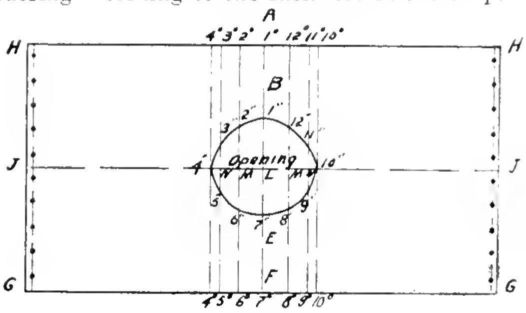


FIG. 10.

allowances to be added as required. Fig. 4 shows the completed templet for a riveted connection. To develop the cylinder H, A, B, E, F, G, Fig. 2 calculate the stretchout of which F G is the diameter. F G equals 1 inch, the stretchout will therefore equal 1×3.14 equal to a little more than 3⅛ inches.

Measure off G G Fig. 5 equal to 3⅛ inches. Draw H H parallel and equal to G G and the distance apart H G equal to the length of the pipe which is 2½ inches as measured by the length A F or H G, Fig. 2. As the pipe A F G H, Fig. 2 is a right cylinder, so will the outline H H G G be a perfect rectangle, that is to say its opposite sides being parallel and its angles right angles. This plate may be squared up by the process as explained in an earlier article of this series.

Bisect G G at F, Fig. 5, erect the perpendicular F A. Measure along the curve the distance 7^2 6^2. Fig. 3 transfer this over to 7^0 6^0 Fig. 5. Again take the length 6^2 5^2—along the curve—Fig. 3 and transfer over to Fig. 5 as 6^0 5^0. Also transfer the distance 5^2 4^2 Fig. 3 to 5^0 4^0 Fig. 5. Similarly make the distances 7^0 8^0, 8^0 9^0, 9^0 10^0. Fig. 5 equal, to their distances as denoted by their respective numbers in Fig. 3. Erect perpendiculars from these points to the line H H and number as shown. Bisect H G at J and draw in the line J J. Fig. 5. Set the dividers to the distance LI^2, Fig. 2 and transfer over to LI^2 Fig. 5. Reset the dividers to $M2^2$ Fig. 2 and again transfer to Fig. 5 as $M2^2$. Make $N3^2$ Fig. 5 equal to $N3^2$ Fig. 2. Similarly transfer over the remaining distances in Fig. 2 to their corresponding numbers in Fig. 3. An even curve drawn through these located points, will define the mitre line or the opening in this pipe. The rivet lines and hole centers are drawn in according to requirements. Fig. 4 shows the rivet holes to connect to the corresponding rivet holes in Fig. 5. It is extremely difficult to have these holes come fair, after rolling up and fitting together of the pipes, due to errors of workmanship in flanging and rolling. Generally one or the other is left blank regarding holes. The pieces being fitted together, marked off and then drilled or punched as the case may be according to the facilities of the shop. The general practice for light work is to put the holes in the vertical piece before rolling, then fit it to the horizontal pipe, afterwards drilling the holes through. In heavy work the holes are put in the pipe with the opening also before rolling, and the vertical piece is then fitted on, marked off and then punched. Fig. 5 shows the completed templet for the horizontal pipe shown in the perspective view Fig. 1.

Intersections of Unequal Diameters.

It will be observed that the mitre line is slightly different in the perspective view Fig. 6 than was in the preceding problem.

The side and end elevations are shown in Figs. 7 and 8 respectively. Measure off H G Fig. 7, 2½ inches long. H A is drawn at right angles to H G and is equal in length to the diameter of the large cylinder which is 1½ inches. Draw A F parallel and equal in length to the line H G. Bisect A F at L and raise the perpendicular 10, L, J. Measure L B and L E each equal to ½ inch, thus making the diameter B E of the small cylinder equal to 1 inch. Parallel to 10, J, draw the perpendiculars C B and D E each ¾ inch in length, connect C to D, completing the side elevation outline.

The plan view of the small cylinder is drawn above C D and divided into any number of equal spaces. It is desirable in order to facilitate the drawing of the construction lines and the developments, that the numbers of divisions be divisible by four, so that four quarters of the cylinder will be located with two of the points on the centre line vertically and two horizontally as shown in the plan views, Figs. 7 and 8. The number chosen here is 12, the four quarters being then each divided into three equal spaces. Number the points as shown. Project all points so numbered through A F and parallel to the centre line 10 J.

Project the axial line K K Fig. 7 to K^1 Fig. 8. With radius equal to K F Fig. 7, and centre K^1 Fig. 8, draw the circle in Fig. 8 representing the end view of the cylinder A F G H. Fig. 7. Draw the centre line 7 K^1 P Fig. 8 parallel to 10, J Fig. 7. Draw the line 4^1 10^1 Fig. 8 in line with and equal to CD Fig. 7. The outline of the vertical cylinder is completed by connecting 4^1 to 4^2 and 10^1 to 10^2, these lines being parallel to the centre line 7 K^1. Draw the plan view 1, 4, 7, 10, and number in relation to Fig. 7, keeping in mind that the plan view in Fig. 8 is turned one-quarter round to correspond with end view Fig. 8. Project all the points to the section of the cylinder J 7^2 J Fig. 8. Project these numbered points as 4^2, 5^2, 6^2 etc. Fig. 8 by straight and parallel lines till they intersect similarly numbered vertical lines in Fig. 7. A suitable curve drawn through these points in Fig. 7, defines the mitre line. D C D Fig. 9 equals 3⅛ inches, this being the calculated stretchout of the dia. C D Fig. 7. Divide D C D into 12 equal spaces numbered accordingly. Draw in the perpendiculars equal in length to the perpendiculars of C B J E D Fig. 7. A curve drawn

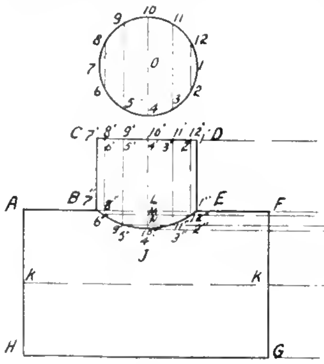


FIG. 7.

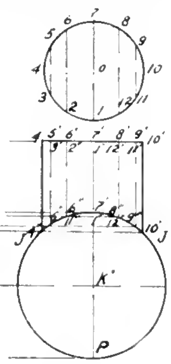


FIG. 8.

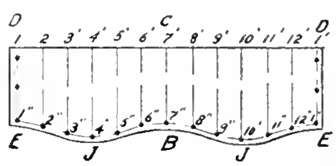


FIG. 9

through these located points will define the mitre line or flange line. The rivet line and lap, or seaming allowances being added accordingly. It will be noticed that the contour of the mitre line of this templet is slightly different to that of the templet Fig. 3 for the equal diameter cylinder intersections.

Measure off G, F, G, Fig. 10 equal to

the stretchout of the cylinder J, 7^2, J, P, Fig. 8 of which P 7^2 Fig. 8 or F G Fig. 7 is the diameter. This equals 1½ inches multiplied by 3.14 equals 4.71 or nearly 4¾ inches. Erect the perpendiculars G H, G H. Fig. 10 at right angles to G G, and equal in length to H G Fig. 7. Connect H to H which will be parallel and equal in length to G G.

Bisect G G at F and erect the perpendicular F, A. Measure 7^0, 6^0, 6^0, 5^0 5^0, 4^0, etc., Fig. 10 equal to the length measured along the curve of 7^2, 6^2, 6^2, 5^2, 5^2, 4^2, etc. Fig. 8. Erect vertical lines on these points as 4^0, 4^0, 5^0, 3^0, 6^0, 2^0, etc. Fig. 10. Bisect H G at J and drawn in the line J J.

Mark the intersection of line J J with line 1^0 7^0, with the letter L. Locate M and N in a similar manner. Now lay off the distances L, 1^2, L, 7^2, M, 12^2, M, 8^2, etc. Fig. 7 in their respective positions in Fig. 10. Draw in the curve defining the opening Fig. 10. Draw in the rivet line and space off the rivets. Space off the rivets at H G and add on the laps. This completes the templet.

Re-enforced Tee.

The perspective view Fig. 11 illustrates a tee pipe re-enforced by a shoulder collar, to resist vibratory strains, etc. Fig. 12 shows the side elevation, while the end elevation is shown by Fig. 13. To construct these views, measure off C D Fig. 12 equal to 3 inches, and A C and D B equal to the diameter of the cylinder—drawn at right angles to C D, and equal to 1 inch in length. Connect A B which is parallel to C D. Bisect A B at L and draw the perpendicular 10, J. Measure of L, 10^1, equal to 1 inch. At right angles to this line, through the point 10^1, measure off 10^1, 7^1, and 10^1, 1^1, each equal to ½ inch, making the diameter 7^1 1^1 of the vertical cylinder equal to 1 inch. Draw the lines 7^1 R and 1^1 R parallel to the centre line 10, J. Mark R, 1^0, R 1^2, R 7^2 and R 7^3 each equal to ½ inch. Connect the point 1^2, 1^3, and 7^2, 7^3. With centre O and radius equal to 4^1, 7^1, construct the plan view 1, 4, 7, 10, as seen through E F. Divide into 12 equal spaces, number and project the points down through E F. Number these also in relation to their position. Now construct the end elevation, Fig. 13. Bisect B D at K Fig. 12. Draw the line K Fig. 12 to K^1 Fig. 13 parallel to A B and C D Fig. 12. With K^1 Fig. 13 as centre and radius K B or K D Fig. 12, describe the circle P, 4^0, 1^0, 10^0. Draw the centre line K^1, 7, Fig. 13 parallel to the centre line 10, J, Fig. 12. Project the line E F Fig. 12 over to 4^1, 7^1, 10^1 Fig. 13. Draw 4^1, 4^0, and 10^1 10^0 parallel to the centre line K^1, 7, tangent to the circle 4^0, 1^0, 10^0, P^0, locating the points 4^0 and 10^0 on the line K K^1. With centre O Fig. 13 describe circle 1, 4, 7, 10, with a diameter equal to the diameter 4^1 10^1 of vertical cylinder. Divide this plan view into the same number of equal parts as the plan view Fig. 12. As this

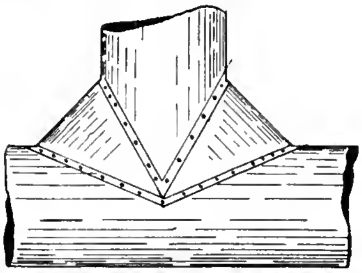


FIG. 11.

view Fig. 13 shows a quarter turn of the view in Fig. 12, the point 1 will commence on the centre line 7 K^1, the remaining points being numbered in their consecutive order in relation to the position of point 1.

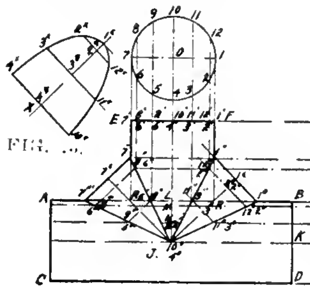


FIG. 12.

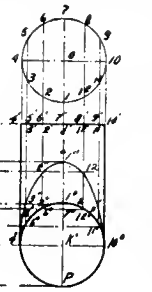


FIG. 13.

Project all these points down to the circle P, 4^0, 1^0, 10^0. Number their intersection accordingly. Project the points 4^0, 10^0, Fig. 13 over to their vertical projection in Fig. 12 thus locating the points 10^0, 4^0 at J, Fig. 12. Connect point J by straight lines with the points J, 1^2, J, 1^0, and J, 7^3, J, 7^2. These lines will define the mitre lines of the several pieces to be developed. From

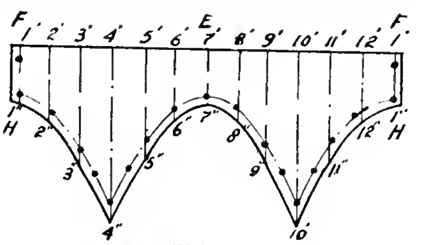


FIG. 14.

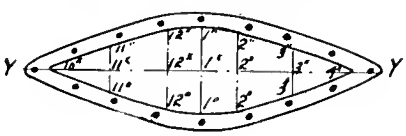


FIG. 16.

the points 1^0, 2^0, 3^0, 4^0, 5^0, etc., in Fig. 13, project over to the mitre lines 4^0 7^3, and 4^0 1^0, Fig. 12, locating points 1^0, 2^0, 3^0, 4^0, etc. Note where the vertical projectors intersect the mitre line 7^2, 10^2, and 10^2, 1^2. Number these points in respect to their vertical projectors, connect the points 2^2 to 2^0, 3^2 to 3^0, 6^2 to 6^3, 5^2 to 5^3, these lines being parallel to the lines 1^2, 1^0 and 7^2, 7^3. These points may be projected over to Fig. 13 to show the side elevation of the collar, but this is not essential for the development of any of the patterns. In fact the whole of the side elevation view need not have been drawn.

In this case it was done to demonstrate the method of solving the problem. A half section view drawn in the diameter B D, would have given all the information required. If there is any doubt in the minds of the readers regarding the construction it would be better to draw both views thus being enabled to grasp the subject more thoroughly. Further advancement in the practice of these problems, would necessitate more or less construction lines according to the class and character of the work. Fig. 14 shows the templet for the vertical piece in Fig. 12.

Calculate the stretchout of E F Fig. 12, and lay this out on the straight line F E F, Fig. 14. This length equals 1 × 3.14 or nearly 3⅛ inches. Divide F E F into 12 equal divisions. Through these points draw perpendiculars and number them according to the divisions and numbers of the plan view in Fig. 12. Take the distance 1^1, 1^2, and 7^1, 7^2, and transfer over to 1^1, 1^2 and 7^1, 7^2, Fig. 14. Set the dividers to the distances 2^1, 2^2, 3^1, 3^2, 4^1, 4^2, etc. Fig. 12 and transfer all these distances over to their respective locations in Fig. 14. Draw in an even curve through these points thus defining the mitre line. The connecting flanges being on the collars or gores, the rivet line instead of being added on to the mitre line, Fig. 14, will have to be drawn back towards the line F E F, to a distance suitable so that the mitre line will define the lap. Add the laps for the vertical seams at F H, F H. Then Fig. 14 will show the complete templet for vertical piece as shown in Fig. 12.

To develop the horizontal course Fig. 12, calculate the stretchout of the cylinder of which B D is the diameter. Measure this stretchout which equals 3⅛ inches along the line C A C Fig. 17. Draw D B D parallel and equal to C A C, and make D C, the distance apart equal to the length of the cylinder D C Fig. 12. The line D C is drawn at right angles to C A C. Bisect C A C to locate A. Raise the perpendicular A B to the line D B D. Measure off the distances 7 to 6, 6 to 5 and 5 to 4, etc. Fig. 17, equal to the distances 7^0 to 6^0, 6^0 to 5^0, 5° to 4°, etc. Fig. 13 measured along the curve. Erect perpendiculars through these points, parallel to the line A B. Now take the distances L, 1^0, and L 7^3, Fig. 12, transfer this over to L, 1^0, and L, 7^3, Fig. 17. Similarly transfer the distances M, 6^3, M, 2^0,

X, 5', X 3°, etc., Fig. 12 over to their corresponding numbers in Fig. 17. Draw in the curve to define the mitre line which is also the opening. Rivet line being afterwards drawn in according to the laps of the gore. To develop the gore it is necessary to show an end view of the centre gore line 1^x 4°, Fig. 12.

To construct this section, draw the line $X1^x$, Fig. 15 parallel to the line 4° 1^x Fig. 12. Transfer the distances 1^x, 2^x, 2^x, 3^x, 3^x, 4°. Fig. 12 to the distances 1^x, 2^y, 2^y, 3^y, 3^y, 4^y. Fig. 15 . It will be observed that the distance through the points 2^z, 12^z, is equal to the distance through the points 2^1 12^1, which is shown in the plan view 2 to 12 measured along the projector, Fig. 12. As both the intersecting cylinders are equal, the distance 12^o, 2^o, as shown by 2^o, 12^o in Fig. 13 is equal to 2, 12, Fig. 12. Take this distance and place half at each side of the point 2^y along the line drawn at right angles to $X1^x$, thus locating the points 2^x and 12^x Fig. 15. Make 3^x 3^y 11^x Fig. 15 equal to the straight line distance 3, 11, in plan view Fig. 12, thus defining the section distance through the points 3^z, 11^z, and 3^o, 11^o Fig. 12. Similarly transfer the distance 4, 0, 10, Fig. 12 to 4^x, Y^x, 10^x, Fig. 15. A fair curve drawn these points represents the section shown through the straight line 4° 1^x in Fig. 12. The stretchout of this curve is laid out on the line Y Y Fig. 16. It is divided up into the same distances as on the curve Fig. 15. Draw lines at right angles through these points.

Take the distances 1^x, 1^z, and 1^x, 1^o Fig. 12, and place this distance to locate the points 1^z and 1^o on the line 1^z, 1^x, 1^o Fig. 16. Again transfer the distances 2^x, 2^z, 2^x, 12^z, 2^x, 2^o, and 2^x, 12^o, Fig. 12 over to their similarly numbered positions in Fig. 16. Transfer the remaining measurements over to Fig. 16. Through these points draw a fair curve. This curve will be the mitre line and in this case also the flange line. Add on the rivet line and laps. Fig. 16 shows the complete templet for either of the two gores.

BOASTFULNESS.

THE art of advertising or of making known to those concerned the merits of what one has to sell varies in method according to the public to which the advertisements are addressed. When advertising pills it may do to state that they are worth a guinea a box, although sold at 27 cents, and in spite of the fact that everyone who reads the advertisement knows the statement to be untrue. The object of the advertiser is not to deceive the buyer as to the value of the pills, but to ensure, by the constant repetition of their name, in conjunction with a striking phrase that when pills are required his own make will naturally come to mind and be purchased. Advertising of this kind is very popular, and undoubtedly has a certain hypnotic value when selling anything whatever, but is not to be recommended when the intention of the advertiser is to instill confidence in the productions and in his advice as an expert.

The buyer of a machine tool depends to some extent on makers' advertisements for information, and such being the case he has a right to expect that they shall be reliable and free from boastfulness. Boastfulness is easily detected and destroys the confidence of the buyer, thus defeating its own ends. Examples of this kind of advertising can be seen in most of our technical journals. One maker advertises "Perfection in Design," which we know has not yet been attained anywhere. Another that the teeth of his milling cutters being large are therefore exceptionally strong—which does not by any means

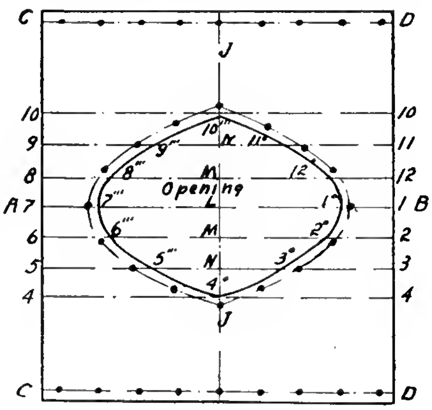


FIG. 17.

follow. The way to make teeth strong is to make them thick, which was not done in the case in question, as the illustration accompanying the advertisement clearly showed.

A third illustrates an article 28 feet in diameter, weighing 90,000 lbs., stated to be "True to one-thousandth of an inch," which, if a statement of fact, can only be so under very restricted conditions of position and temperature, and is probably quite necessary.

Such statements convey an impression of boastfulness in style, which is only too often accompanied by inferiority in matter.

Bold and striking statements are by no means inadmissible in engineering advertisements, providing they are true and capable of proof or of demonstration, but it is nevertheless wise that they should contain a little less rather than a little more than the truth.—Herbert's Monthly.

Hamilton, Ont.—The Hamilton Machine Gun fund now totals $105,000 and contributions continue to come in steadily.

TUNGSTEN.

TUNGSTEN is one of the many raw materials, the value of which has been greatly enhanced as a result of the war. It is a most important ingredient of high-speed steel, and the increased demand for that product itself, rendered necessary by shell manufacture, would be sufficient to cause a large advance in price. While most of the tungsten hitherto used in Britain has had to be imported, it is good to know that this metal is now being prepared from raw material obtained in the County of Cornwall, England.

Although most of the tungsten produced by different countries is used in steel making, considerable quantities are required in the manufacture of incandescent electric lamps. The material as received by the lamp makers is in a powdered state, and the Society of Engineers (London) recently had an opportunity of seeing it being made into the thread-like wire so familiar to all users of electricity. The tungsten powder is compressed into small bars by hydraulic pressure, and is afterwards purified at a very high temperature by a hydrogen flame.

After being treated with electricity to increase the solidity, it is gradually swaged down at a high heat, till it is small enough to be drawn through dies in the ordinary wire drawing manner.

PROPOSED MUNITIONS FACTORY FOR "AMATEURS."

MUCH interest is being taken in North-East Coast shipyards and engine works in the proposed establishment for the making of munitions of war by technical and unskilled part-time workers.

The proposal is that a munitions factory should be established in Newcastle, the capital to be found by the Government, as was the case in connection with the Leeds munitions factory. The promoters aim at a small factory as a beginning, which should have twenty lathes, and would cost about $25,000. There will be no difficulty, it is understood, in obtaining lathes, and suitable buildings can be secured. The labor will be provided by part-time men of skilled occupations, such as draughtsmen and others who have served an apprenticeship to technical trades, while quite a number of commercial men will be available who are fair mechanics. A few permanent officials will of course be required.

The proposal seems eminently practicable, and, since the need exists for taking advantage of both large and small offers of assistance in munition-making, it is likely that the Government will make use in some form of the proposal.

PRODUCTION METHODS AND DEVICES

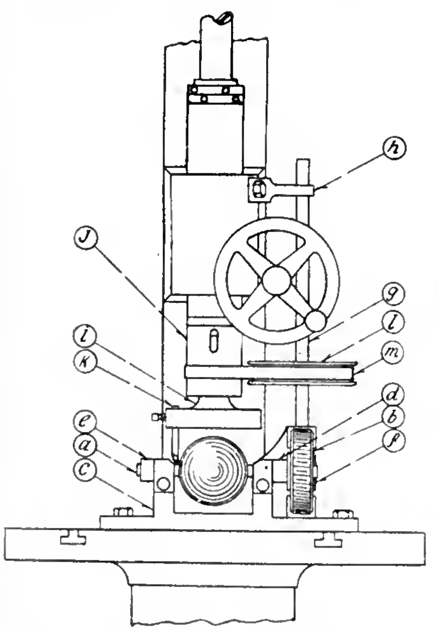
A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

BALL TURNING ON A DRILL PRESS

By J. W. Innes.

THE accompanying sketch illustrates the method adopted in a shop some time ago for the manufacture of a quantity of small brass balls used in the construction of a certain make of check valve. While no high degree of accuracy was required the balls were necessary to be approximately round. To produce these in fairly large numbers was a problem that the foreman had to solve. There being no suitable device in the shop with which to accomplish the required result, the fixture here shown was designed and used with very much satisfaction, both in quantity and quality of production.

The finished balls were of 2 in. dia. A small hole ½ in. dia. was drilled through the centre of the rough casting. It was then driven on the arbor (a). On one end of this arbor was secured the worm gear (b). The arbor was then placed in the jig (c) (which was secured to the drill table with the ball in a central position) and held in position by the collars (d) and (e). The worm (f) was secured to the shaft (g) which passed through and revolved in the bearings of the jig (c) and bracket (h). The shank of the tool-holder (l) was



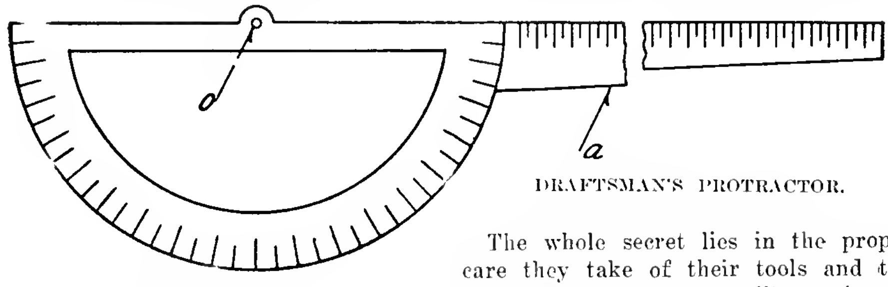
BALL TURNING ON A DRILL PRESS.

turned to fit the drill spindle (j) and the tool (k) was made to suit the work in hand and secured by the set screw shown. Secured to the shaft (g) was the flanged pulley (l), which was driven from the drill spindle by the belt (m).

The operation was as follows: After jig and tool-holder were properly set and secured, the drill spindle was lowered until the tool came to the proper position. The spindle then being secured in this position, the action of the mechanism caused the ball and arbor to revolve and thereby remove the metal.

After removing the ball from the arbor, the hole in the centre was closed, the construction of the valve preventing the plug from coming in contact with the valve seat.

The work produced from this fixture was highly satisfactory and well repaid the expense of the construction.



DRAFTSMAN'S PROTRACTOR.

DRAUGHTMAN'S PROTRACTOR.

By J. Garth.

THE sketch herewith shows the design of a protractor which extends the usefulness of those ordinarly seen on the draughtsman's table. The feature of this design is the extended arm (a) and the small centre hole (o). By means of this small hole a fine point can be inserted through the protractor and into the intersection of the two lines which form the required angle. By revolving the arm (A) about the centre (O) any desired angle is readily obtained.

CARE OF THREADING DIES AND PIPE CUTTING TOOLS.

By P. W. Blair.

OWING to the universal use of dies for the cutting of screw threads on pipes and rods they should receive far more and better attention than is commonly accorded them.

The proper care of the dies and lubrication of same when in use is one of the greatest factors of economy that has to do with their use, and the cutting of screw threads has become one of the most important parts of nearly every line of manufacture of metal products.

In some cases the greatest limits of accuracy are required in the production of threaded parts and it is often remarked by users of stocks and dies, "How is it that I cannot cut so accurate and smooth threads as are on some of the fittings or bolts I have just purchased?"

The whole secret lies in the proper care they take of their tools and the lubricant used. As an illustration, a screw thread may be satisfactory if the parts merely have spiral marks which can be forced into a tapped hole and once in place it is out of sight and may never be discovered, consequently in some instances almost any kind of a thread will pass.

There are, of course, all sorts and conditions, but it seldom requires as much time to produce a perfect thread as it does the other kind, and the good thread can be produced with far less wear and tear on the tools.

If a man becomes sick he usually calls a physician and has his trouble diagnosed and suitable remedies applies. He rarely ever applies the same methods to his business. If a tool goes wrong and does not operate satisfactory he does not spend much time trying to discover the cause of the trouble. If the trouble cannot be removed by the first application of his "remedies," the tool in many cases is condemned as being no good anyway, and he may also have something to say to the maker of such a tool.

In applying a lubricant for the cutting of pipe, bolt and other screw threads, similar results may be arrived at. Some users seem to thing that any kind of a lubricant can be used; consequently an oil of some kind is used but seldom with proper regard, if any, as to whether the oil is suitable for the purpose. One of the most desirable features of screw cutting is to obtain the greatest quantity and quality of the work with the least wear and tear upon the dies.

It does not follow that because you have been using a poor grade of oil with fairly good results, that the same will be obtained when a new shipment of pipes or rods requires threading. The quality of the stock may vary to such

an extent that a different grade of lubricant is almost necessary.

Many users of thread cutting dies may still maintain that a tool that will cut a good thread with one grade of oil should give satisfaction used with any oil. Not only should suitable lubricants be used for various grades of metals but also in the cutting of different metals.

Many large manufacturers carry quite a number of different oils and lubricants, and are still experimenting to obtain better results.

All stocks and dies when not in use should be kept in a suitable place and thoroughly cleaned of foreign substances, so that when they are again required they shall be in good condition.

SIMPLICITY IN TOOL DESIGN.

SIMPLICITY in tool design may sometimes be more apparent than real, and elaboration in the right direction often results in real economies. Most people familiar with the principles of tool design realize this, but too often one sees designs which are the outcome of a short-sighted view. As an instance, we may consider the machining of a large bevel gear, such as is used in motor car differentials. This would be made from a steel stamping, and two variant methods of machining on automatic turning machines are commonly seen, one bad, and the other good.

In the first method, the large bevel face is attacked with a roughing cutter in the form of a broad serrated flat blade, which is followed by a similar finishing cutter not serrated. This looks "simple" and turns out the work rapidly for a short time, but the hard scale soon plays havoc with the serrated roughing tool, and when it requires grinding it has to be returned to the tool room, being too difficult a job for the operator to tackle.

In the second method, one sees the bevel face traversed by a single point tool carried on a slide mounted on the

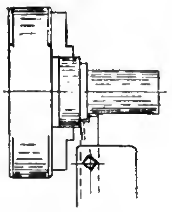


FIG. 1.

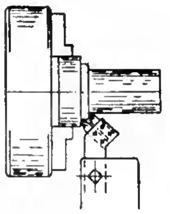


FIG. 2.

SIMPLICITY IN TOOL DESIGN.

cross slide, and actuated by a suitable former cam. The actual cutter is only a small piece of rectangular high-speed steel, which can be quickly made and reground by the operator himself. The initial cost of the latter arrangement is certainly the greater, but there is no question as to which is ultimately the better.

On another job, one finds two shoulders close together that have been faced from the cross slide. A bad method employs a facing tool with a step ground on it, the same width as the distance between the shoulders (Fig. 1). This again is "simple," and works well until one of the cutting points gives out, when again re-grinding is a tool-room job.

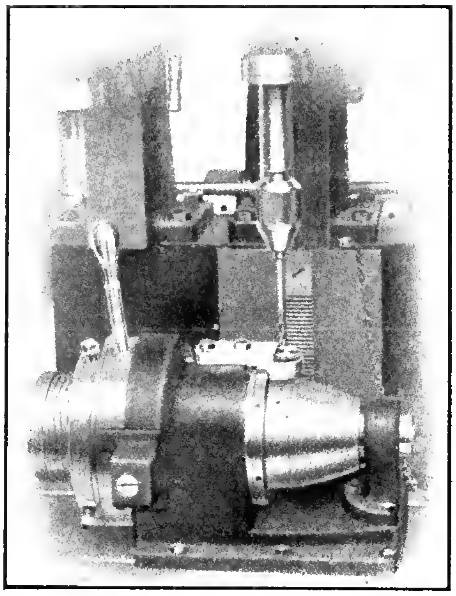
The better method (Fig. 2) utilizes a small tool holder carried in the cross slide tool block, the cutting tools being two small pieces of steel which can be set the correct distance apart. These, again, are easy to re-grind, and cheap to replace, although the initial cost is the greater of the two.

Many similar instances could be cited, but enough has been said to show that the initial cost is not the last cost, and the best designs utilize cutting tools in the simplest possible form, which can be re-ground and, if possible, made by the operator himself.

DRILL JIG FOR SHRAPNEL SHELLS.

THE noses of the larger shrapnel shells are made separate from the bodies, and are held in place by a number of pins and screws. When the charge in the base is exploded, the screws are sheared and the head blows off, allowing the bullets to scatter.

On the 60-pounder shell there are eight screws and eight pins, the holes for which are drilled and tapped with the head and body assembled. The illustration shows a type of jig used in conjunction with a ball-bearing drill which has given much satisfaction wherever employed. The jig is semi-automatic in its action, and consists of a casting bored to receive a sleeve in which the shell is clamped, while at the right-hand end a small bracket and locating plug support the nose.



DRILL JIG FOR SHRAPNEL SHELLS.

When the operator pulls the handle towards him, the locking bolt is withdrawn, and on pushing it back, the sleeve carrying the shell rotates until the bolt drops in again. This jig is exceedingly rapid in action, and the whole arrangement very compact.—Herbert's Monthly.

GUNS v. TORPEDOES.

BEFORE the war started the gun was generally looked upon as the most effective weapon, but the success of submarines in the early stages of the war probably altered the balance of opinion. In making a comparison, it must be remembered that recent naval warfare has favored the use of the torpedo and given little chance to the gun. If the torpedo is to be a success at all it must be used at short ranges, and, generally speaking, the submarine is the only vessel which renders this possible.

In naval battles fought before the advent of the submarine the percentage of hits with torpedoes was notoriously small. On ships stationary it was somewhat more successful, but very few vessels in motion were destroyed by torpedo attack. The destructive power of the torpedo, should it get home, is unquestionable, but its small speed compared with that of a shell is its great drawback.

The maximum velocity of a torpedo is not more than 45 knots, and this is reduced as the distance covered increases. Even the modern torpedo takes nearly three minutes to cover two miles, and in this time the relative speeds and courses of the passing vessels may be entirely altered, and large surface vessels would not approach one another so closely unless gun-fire had already done its work. It is only when used in a submarine that the torpedo is effective, and only then when the presence of the underwater vessel is undetected.

In the few naval engagements that have been fought in the North Sea, where it would be reasonable to assume that submarines would be valuable, their success has been nil, and the inference is that high speeds and good manoeuvring are all-sufficient to destroy the aim of the torpedo officer. Taking vessels destroyed during the war, slightly more have been destroyed by gun-fire than by torpedoes from submarines. The few isolated cases where surface craft have successfully launched torpedoes are quite special and cannot be taken as precedents. It can safely be predicted that when the big ship actions come, the victory will be obtained by gun-fire and gun-fire alone, and it is to these actions that the British Navy looks forward with every confidence—L.J.C.

EDITORIAL CORRESPONDENCE

Embracing the Further Discussion of Previously Published Articles, Inquiries for General Information, Observations and Suggestions. Your Co-operation is Invited

HEALTH HAZARDS AND SAFETY PRECAUTIONS.

By J. M. W.

A STUDY of recent developments of applied science show that the first applications of many new inventions have been characterized by great indifference to their effect on operators. The complete success of oxy-acetylene welding and similar processes has been accompanied if not made possible by suitable precautions to safeguard the health and comfort of the men engaged on the work.

Oxy-Acetylene Welding.

The adoption of oxy-acetylene welding has been so rapid, and the different branches of industry which offered suitable opportunities for its use so numerous, that the trade obtained a wide field of activity before manufacturers obtained a true appreciation of its attendant hazards.

The type of apparatus varies considerably with the nature of the work. Small portable repair outfits are noteworthy principally because the gases are contained under pressure in storage cylinders. Fixed plants such as are used in shops specialising on welding consist of an acetylene gas generator which supplies this gas under a suitable pressure. The oxygen is usually obtained in cylinders from firms which specialize in the manufacture of this gas.

When using both gases from cylinders the cylinders are fitted with valves so as to maintain the supply of gases at the proper pressure. These valves are automatic in action and reduce to a minimium the risk and attention required from the operator.

Portable generators are not desirable on account of the necessity when traveling, for removing the water and carbide. Any carelessnes in this respect may allow sufficient quantities of carbide to come in contact with damp or moisture and generate enough gas to cause a severe explosion. Additional care and common sense must be exercised when handling generator plants as compared with storage cylinders.

Cleaning Out the Gas Generator.

The use of an open flame light when cleaning out a generator is a fruitful source of accident. When starting to clean a generator, the gas may be released through a suitable exit until the pressure gauge falls to zero. But the fact that the gauge is at zero does not mean that there is no gas inside. It means that the gas which is inside is at zero pressure, and unless that remaining volume of gas has been displaced or allowed to pass out, so that the space which it occupied is filled with air, it will still be in the apparatus waiting for the first opportunty to ignite. When the generator has been safely opened, any remaining water which has not been completely drained off should be carefully mopped up and all traces of dampness removed before cleaning out the carbide. Especially is this the case where the construction of the generator is such that the carbide may cake and remain on the walls, as lumps of this caked carbide may be capable of generating a dangerous quantity of gas should they come in contact with unexpected moisture.

These considerations will make quite apparent the criminal negligence which accompanies the use of an open flame light around a generator at any time. A portable incandescent electric lamp is the only source of illumination which should be legally permitted.

Welding Apparatus Perfection.

The welding apparatus proper—blowpipe, torch, etc.—has been brought to a very high state of perfection by the various makers, and all the details such as control valves, flexible piping, etc., are capable of satisfactory service for long periods. In spite of care, couplings will become loose, careless workmen may burn holes in hose pipe, etc., and these defects are not readily detected because of the all pervading odor of acetylene gas which is an almost unavoidable feature of all plants. An accumulation of such small leakages may have disastrous consequences to the operator.

Hazards resulting from the foregoing conditions are of an active nature and their results are rapid and evident.

Hazards of a passive, but not less certain and detrimental nature are those which affect the operator physically and continually.

The most attractive feature of gas welding is the intensely strong light which is given off by the flame. While an ignorant and stubborn operator may spurn the use of protecting glasses, the effect on the sight soon makes itself felt, so that for self protection alone the adoption of glasses is a matter which soon adjusts itself. Recent experiments with tinted lenses in efforts to obviate the blinding effect of automobile headlights, have brought about the use of amber colored glass which effectually removes the glare without obstructing the vision so much as the ordinary smoked lenses do.

In addition to having them of the most suitable tint, the lenses should be of substantial dimensions and firmly secured in a strong frame. The presence of foreign substances may cause sparks of molten metal to be thrown off the work, and occasional moisture causes spurting of the job which should be properly guarded against.

Constitutional Feature.

Lastly the effect of the work generally may be such that occasionally a particularly expert operator, through some constitutional weakness, may be incapacitated much more quickly than another operator less expert but more robust. One has merely to consider the intense heat of the flame to realize that metallic vapors are being given off by the work in close proximity to the operator's face. The products of combustion from the flame itself may well be detrimental to the health without the addition of fumes from copper, aluminum, zinc, etc. The use of a helmet such as is used by sand-blasters is the least protection that can be taken and if used along with a respirator may delay but not permanently prevent the results of continued occupation on welding work.

SPACING OF MACHINES A FACTOR OF SAFETY.

By R. James.

ONE of the causes of industrial accidents is the system—or lack of system—that prevails in many establishments of placing machines without regard to their particular production or the output of those in the immediate vicinity.

How often can one observe the apparently crowded condition of many shops, especially where want of space and need of extra tools almost demand these conditions.

Too often this is done with a view of economy, but very often this same apparent saving has been the cause of many accidents.

To produce satisfactory results from the operation of almost any machine, sufficient space must be left about the floor for the convenience of the operator and also for the product before and after the machining operations.

If this space is not available, the freedom of action of the operator, and therefore the output, must be restricted.

Where two or more machines are crowded together it prevents the operators from giving proper attention to their respective duties.

If the men are on a day rate system, and the movements of one in placing or removing work interferes with the other, the second operator, in many cases, must remain idle while the first performs his necessary task.

If the men are working on a piece work basis, the second man will continue his duties, often at the risk of injury to some portion of his body.

The writer has observed an operator turning a wooden pattern, at high speed, on an engine lathe, the face plate of which was directly in line with another man working a lathe a few feet away; suddenly, without any warning the tool lifts the pattern from the face plate and portions of the flying wood are projected at the man working opposite, fortunately missing him by a few inches.

Contracted Aisles.

Sometimes, owing to lack of sufficient space in the aisle between machines, when work must be carried from place to place, a slight slip or shove may cause a person to stumble, forcing him to put out his hand to protect himself from falling. This effort may cause his hand to come in contact with levers or moving mechanisms and the result is possibly an accident to himself or someone working close at hand.

Another source of trouble may result from the placing of machines, such as screw machines and hollow spindle lathes, etc., in positions where the projecting parts will cross an aisle or protrude in close proximity to a bench, where other workmen must pass, and often before a warning can be given, the clothes or flesh is badly torn.

A pile of castings or other material will sometimes be placed (perhaps temporarily) in a location where a workman is accustomed to perform his usual duties and is often the cause of injury.

Often, when an accident has happened the injured person must bear the blame, when in reality the local conditions are responsible.

Dust Feature.

The cause of many a short life machine can be traced to the locating of said machine too close to the flying dust and particles from an adjacent grinding machine. The dust from the continual grinding penetrates to all parts of the machine, and the movable parts receive a large supply of this destroying agent: the destruction is so gradual that when the fault is at last noticed the injury, in many cases is beyond repair, or when repaired is not satisfactory.

While the universal cry of "Safety First" is being advocated, any improvement in these conditions would be a step in the direction of advanced economy and increased production, as well as the bettering of the working conditions and moral responsibilities of employer and employee.

BRASS MIXTURES FOR PLUMBERS AND STEAMFITTERS.

By P. W. Blair.

THE wide variety of its application in commercial and artistic lines gives to the making of brass a scope unequalled by few metals. A mixture or alloy designed for any given purpose may be useless for any other purpose. Therefore, the mixture of the metal for any purpose of manufacture is of the most importance. The compound must be so prepared that it will fully meet the conditions under which the article manufactured will be used. Owing to the hard usages and wear that plumbing and steam brass goods are subjected to, and the constant pressure on same, manufacturers of the above lines are improving the quality and alloys of metals they use in the manufacture of this line of goods.

The leading concerns employ a metallurgist in their foundry and know how to mix their metals by analysis and practice by scientific melting in place of the rule and thumb method previously employed, and get results.

The leading authorities on brass goods differ on the question of what really makes the best mixture, but they are agreed that copper in excess of zinc produces the best grade of brass. Copper, however, has inherent defects as a metal which must be overcome by the judicious use of alloys.

Mixture for Good Results.

The following compound is recognized by the leading metallurgists to produce the best results for plumbing and steam brass goods:

Copper	85
Zinc	6
Lead	4
Tin	5
	100.

This produces what is known commercially as red brass, in contra-distinction to yellow brass, which contains less copper and more zinc, and is consequently a much less expensive metal, and which is also of more coarse grain metal and more brittle.

The mixture I have just given the above formula for, might with propriety be called a bronze composition, as it does not differ materially from the bronze formula given by Hirons, the English authority, which is:

Copper	84.0
Tin	2.9
Lead	4.8
Zinc	8.3
	100

Melting, Mixing and Casting.

The mode of melting, mixing and casting has an important bearing in the final result. In the manufacture of plumbing and steam brass goods from red brass, the constituent parts are, of course, of the utmost importance in forming the foundation of the goods, and play an important part in the final results. It must be taken into consideration, also that the mere mixing and casting of the metal would of itself fall short of producing a first-class metal, if it were not also for the particular process by which the metal is prepared in the furnace and the manner in which it is handled in the casting.

Red brass has many advantages compared to yellow brass in the manufacture of plumbing and steam brass goods.

It is much more pleasing to the eye.

There is an absence of the cheap brassy appearance of the goods which shows to a pronounced effect where zinc is used in large quantities.

It is more tenacious, closer grained, and tensile strength is far superior.

It is fibrous and more tenacious than yellow brass which by reason of the large percentage of zinc is a crystaline.

On this last point, Arthur H. Hirons, principal of the School of Metallurgy, Birmingham and Midland Institute says: "The pastiness of zinc manifests itself decidedly in alloys immediately below those which are fibrous, becoming more strongly marked as the alloys are rich in zinc. The fracture of these white alloys is for the most part vitreous, and glassy. Brass goods which contain a large proportion of zinc are much more susceptible to the action of water and other fluids, and more especially steam. The goods of this character become pitted because of the presence of zinc and are therefore rendered inefficient.

Brass Fittings Underground.

This is especially true of brass goods which are placed in the ground, for then they must resist not only the action of the water and fluids, but also the action of the earth as well.

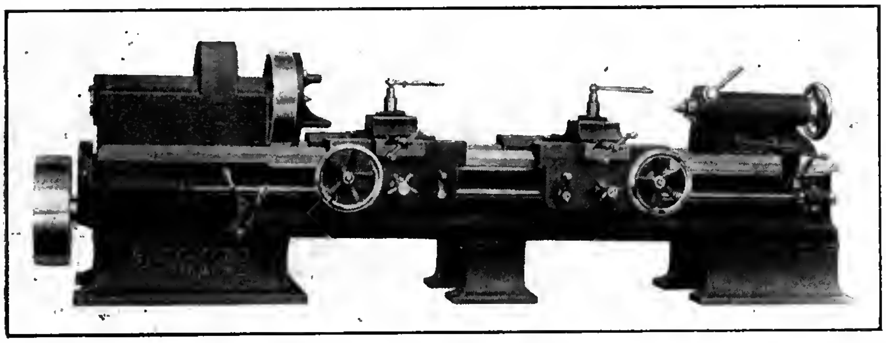
In its strength and qualities red brass is like a piece of good oak, white yellow brass is like a pine board and its wearing qualities are therefore not comparable with red brass.

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

PLAIN TURNING MACHINE.

TO meet the demand for a simple and convenient machine adapted to plain turning requirements, the Bridgeford Machine Tool Works of Rochester, N.Y., have put on the market the lathe illustrated and described in this article. It has fewer parts than an engine lathe, is very powerful, and is simple and convenient of operation.



NEW PLAIN TURNING MACHINE.

There are three mechanical speed changes through heavy cut steel gearing and the use of a two-speed countershaft as furnished with the machine increases the speeds available to six. The feed box gives four changes of feed for each change of gear at the end of the lathe.

The gearing throughout is of steel, the gears for the speed and feed mechanism running in a bath of oil. The main driving gear is 6½ in. face, 3 pitch, with all other gearing in proportion. When motor driven, a 25 h.p. motor is employed. The drive is through constant speed pulley, the two levers at the front of the machine controlling all changes of speeds and feeds.

The lathe swings 27 in. over the ways, 13½ in. over the carriages, takes 8 ft. between centres with standard length of bed, and will work the best of high speed steels to the limit. It can be furnished with one or two carriages as desired.

PIPE THREADING AND CUTTING MACHINE.

THE ability to thread, ream and cut pipe in one continuous operation at twice the speed of existing machines is claimed by the Landis Machine Co., Waynesboro, Pa., for a new line of pipe threading and cutting machines which has been developed and recently placed on the market. These machines are designed to use the well-known "Landis" stationary type pipe die heads, which cover an exceptionally wide range with but one set of chasers. They are massive in construction and are equipped with the most improved mechanical and safety attachments.

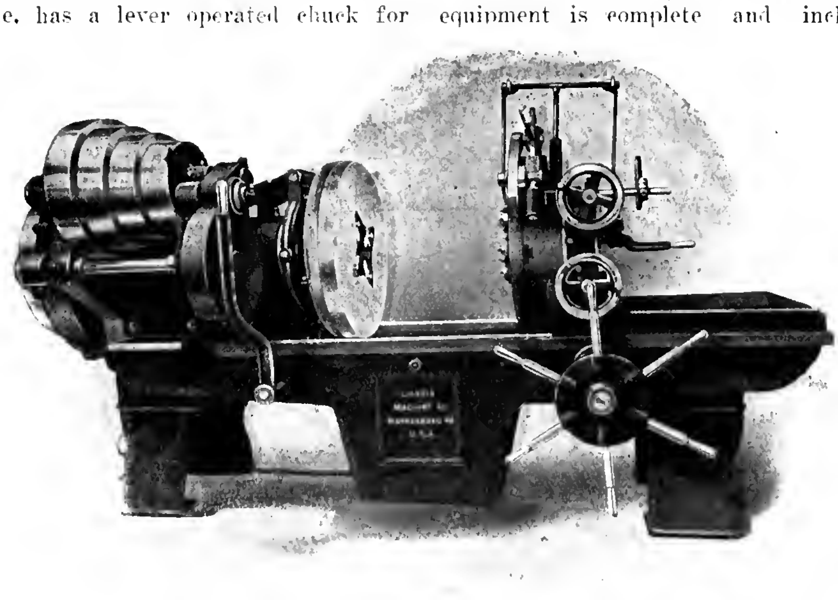
The line consists of three machines capable of threading from 1 inch to 8 inches, inclusive.

The most noteworthy feature of this type of machine is the ease with which it may be adjusted for the different sizes of pipe. This is due to the fact that the die head and gripping chuck have universal diametrical adjustments, and only one set of chasers is required to cover the range of each head.

The illustration shows the 4-inch machine, which, along with the 6-inch machine, has a lever operated chuck for gripping the work. Two stationary type die heads form part of the equipment of each machine, those of the 4-inch machine being one 2-inch (four chaser) head, and one 4-inch (six chaser) head. The Landis chasers are milled from flat bar steel and are hardened their entire length, and unless otherwise specified, are made of high-speed steel for Briggs' standard thread.

It is unnecessary to anneal, hob, or re-temper these chasers during their normal life, which is claimed to be frequently from ten to twenty times that of ordinary style chasers. In addition, the flexible rake and natural clearance between the serrated face of the tool and the surface of the work, eliminate all unnecessary friction at the cutting edge and render it possible to operate at a very high speed. The design of the 2-inch head allows the same chasers to be used for both right and left-hand threading, but the 4-inch head is limited to right-hand work. A point which calls for special attention is the fact that the cutting edge of the chasers can be located in the correct position at any time, irrespective of the amount of wear. The method adopted is simple, and insures the use of uniform and permanent cutting edges at all times.

Distinctive features of design include a universal centering chuck at the rear of the spindle; a one-piece frame with fluid-tight bottom; an accessible cone pulley on top of the machine; and all drive gears enclosed to comply with various factory inspection laws. The equipment is complete and includes counter-shaft, pump, reaming attachment, cutting-off tool, length gauge, pipe grips, nipple grips, wrenches, etc., to handle the work within its capacity.



"LANDIS" PIPE THREADING AND CUTTING MACHINE.

APPLICATIONS OF THE HEENAN COOLER.

THE Heenan cooler has met with much success as a medium for cooling air, which is circulated through the windings and about the armatures of large dynamos and motors. It is also employed for water-cooling purposes in internal combustion engines, etc.

This cooler is designed for the rapid and efficient transference of heat between two fluids, one of which (usually air) is in the gaseous, and the other in the liquid, state. The liquid to be cooled is contained in a tank in which a number of cooling cylinders revolve. These cylinders are built up by means of galvanized steel sheeting wound in the form of a spiral, the whole forming a large cooling surface in a very small space. The lower portion of the cylinders dip in the liquid to be cooled, and through the annular spaces of the upper half air is passed. The cylinders revolve at a slow rate, and are thus continually bringing fresh supplies of the liquid into intimate contact with the air. The cooling is effected partially by conduction of heat between the liquid and the air, and also, in most cases, by evaporation.

Where the liquid to be cooled is water, a small portion of the water, which is picked up by the galvanized steel plate, in the form of a film, is evaporated, and the latent heat required for this purpose is extracted from the metal contained in the cooling cylinders and hence from the liquid in the tank. It should be noted that the liquid is spread over galvanized steel sheets in the form of a thin film, and is not broken up into drops or globules. This means that there is little possibility of a portion of the liquid being carried away from the machine in the form of a loose mixture. The loss by evaporation is, therefore, the minimum possible by which the cooling effect can be produced.

For the purpose of passing air through the machine, a fan is used, which may be of the propeller or centrifugal type, according to the size and design of machine. A general idea of the construction of these coolers as fitted with centrifugal and propeller fans can be gathered from Figs. 1 and 2. The machines are usually driven by belt on to the fan spindle, the drums being revolved by suitable reduction gearing between the fan and the drum shafts. As the cylinders are mounted on ball bearings, they offer practically no resistance, and as the fans are of high efficiency design and construction, the power required to drive the coolers is a minimum. The standard design is somewhat modified when the coolers are to be used for special purposes and in special places. For example, special designs are employed when the installation is to be on board ship or for cooling compressed air.

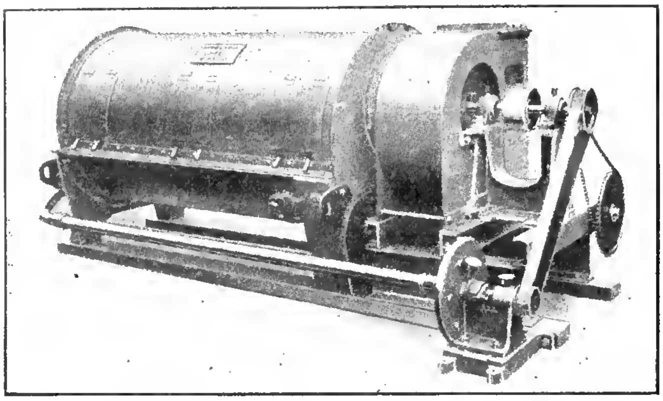


FIG. 1. STANDARD COOLER—CENTRIFUGAL FAN TYPE.

Cooling Water for Internal Combustion Engines.

One of the advantages of the machine when used for cooling water for an internal combustion engine is that it is positive in its action. By which is meant, there is a definite amount of cooling surface and a definite amount of air is passed through the machine per minute. Thus a constant cooling effect is produced. Experiments have shown that the machine is practically independent of climatic conditions, the action being such that all heat is dissipated as fast as it is generated if the machine is of size and capacity demanded by the engine it is cooling. This is a special advantage, and enables an engine to be run night and day for an indefinite period.

The space occupied by the cooler is small, while at the same time the apparatus is quite economical in the use of water. The cooler can be used to ventilate the engine-room, the air being drawn from the engine-room and discharged to the outside atmosphere. In tropical countries, especially, this is a decided advantage, because the air in the engine-room is generally oppressive.

In plants ranging up to 200 and 300 b.h.p. the cooler may be arranged so that the pump delivers the cooled water directly into the engine jackets, after leaving which, the water returns direct to the cast iron inlet funnel fitted on the water cooler. The water then flows

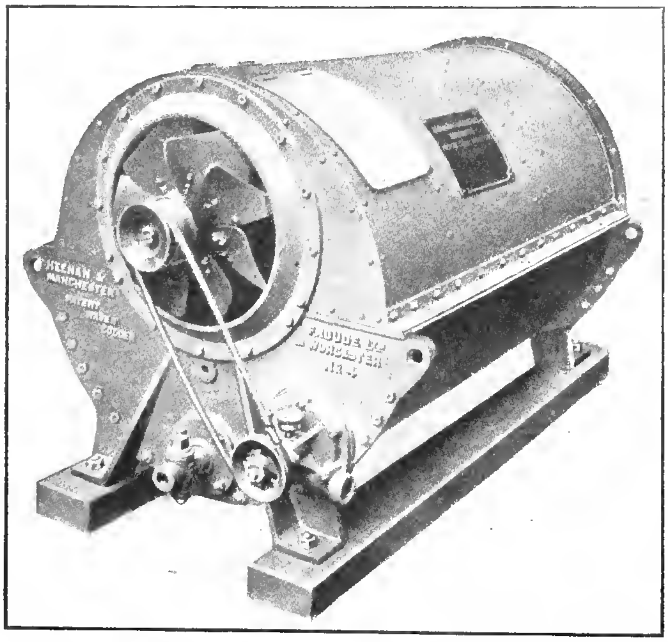


FIG. 2. STANDARD WATER COOLER—PROPELLER FAN TYPE.

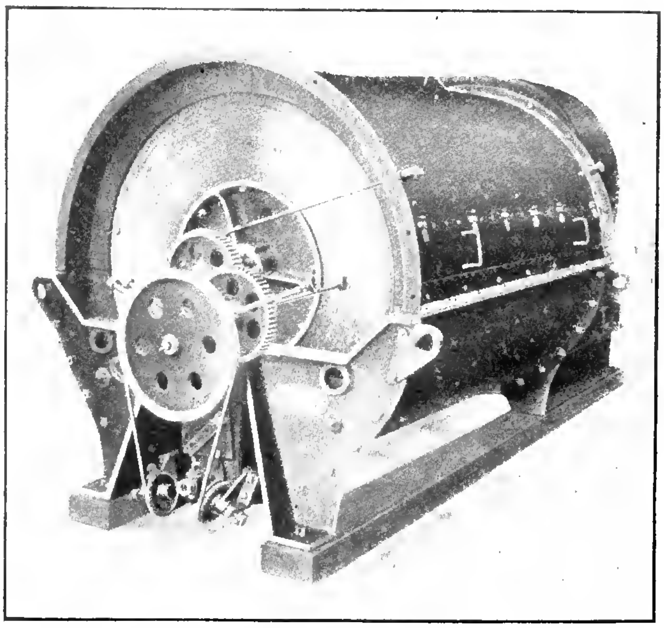


FIG. 5. VIEW OF OPEN END OF STANDARD COOLER.

through the cooler by gravity, and is passed by the circulating pump back to the engine water jackets. The loss of water by evaporation is made up by means of a float valve fixed in a small galvanized iron tank fitted at the side of the cooler, this float valve being connected up to the town's mains or some other source of supply.

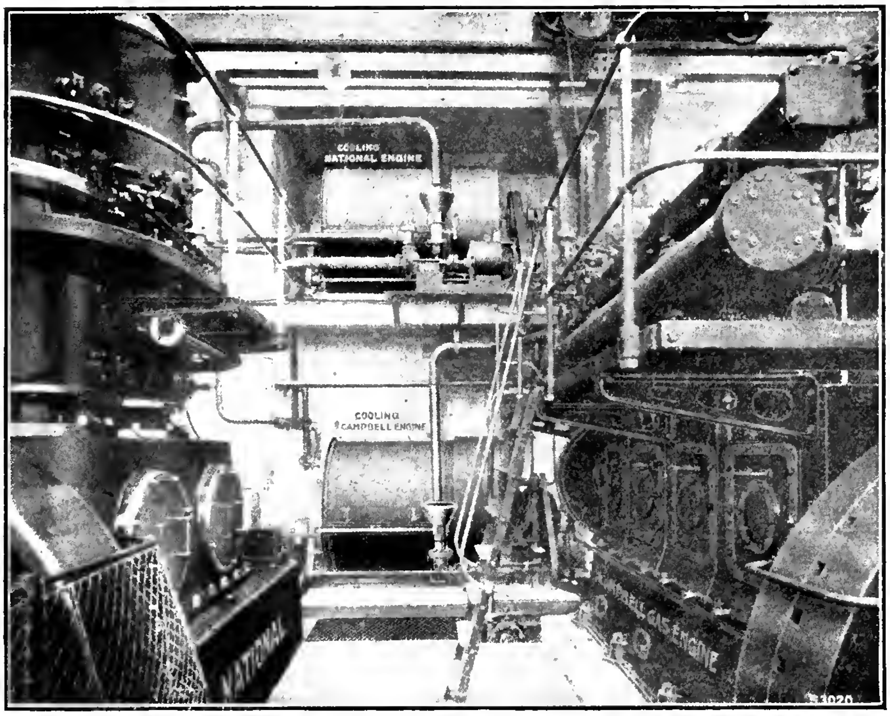


FIG. 3. TWO "HEENAN" COOLERS AT WORK ON TWO 350 HORSE-POWER VERTICAL GAS ENGINES.

With larger plants it is desirable to provide a small storage in the form of a tank or sump let into the ground. Some engineers have preferred a small overhead storage tank in order to provide a steady head on the engine jackets. Speaking generally, this tank or sump should have a capacity of a few hundred gallons of water, and its purpose is to counteract any unsteadiness of the circulating system at starting up, due to the comparatively small amount of water in circulation. When this system is employed, the float valve for making up the loss of water by evaporation should be fixed in the tank or sump. When the latter is provided, the pump should be arranged to deliver the water from the sump to the engine jackets and thence by gravity through the water cooler back again to the sump. If an overhead tank is provided, the water should flow direct to the engine jackets, and, through the water cooler, be returned to the tank.

Various methods are used to drive the cooler, it being often found convenient to drive the machine by means of a belt from countershafting. When electric current is available, however, a small electric motor is employed, the same motor being used to drive the pump. Fig. 3 shows an arrangement of direct coupled, motor-driven pumps, with the water coolers driven by means of belts from pulleys fitted on the shaft extensions of the motors.

It is usually advisable to provide a duct on the air outlet of the water cooler. This is always necessary when the cooler is installed in the engine-room, and even when the machine is working in the open air, it is sometimes advisable to provide such a duct, running, say, from ten to twenty feet vertically upwards. The duct should be of ample cross sectional area so as to offer no resistance to the passage of the air.

Cooling Water Used in Making Ice.

The importance of having cool water for use in plants which are manufacturing ice for commercial purposes hardly need be emphasized. When water is cooled by means of air, the atmospheric wet bulb thermometer limits the temperature to which it can be cooled. An efficient cooling plant is, therefore, necessary to reduce the temperature of water to anything approaching the wet bulb thermometer. With the Heenan cooler it has been shown that it is possible to reduce water to within half a degree or even less of the wet bulb thermometer, but a plant for such a duty would be large and commercially not very economical. Thus, for freezing plants it is the custom to provide machines which will cool the water to within a reasonable limit of the atmospheric wet bulb thermometer. The machine has shown up well under comparative tests in the warm months and in the tropics, and under these conditions shows its best efficiencies. To illustrate the importance of having cool water in a refrigeration plant the following figures will be interesting: One plant, receiving water at 60 degrees F., 70 degrees F., and 80 degrees F., consumed 78.8 h.p., 92.0 h.p., and 106.0 h.p. respectively.

Cooling Water for Air Compressors.

Where water is not very plentiful, it is often found useful to install one of these coolers to cool the water as it comes from the water jackets, and thus use the water over and over again.

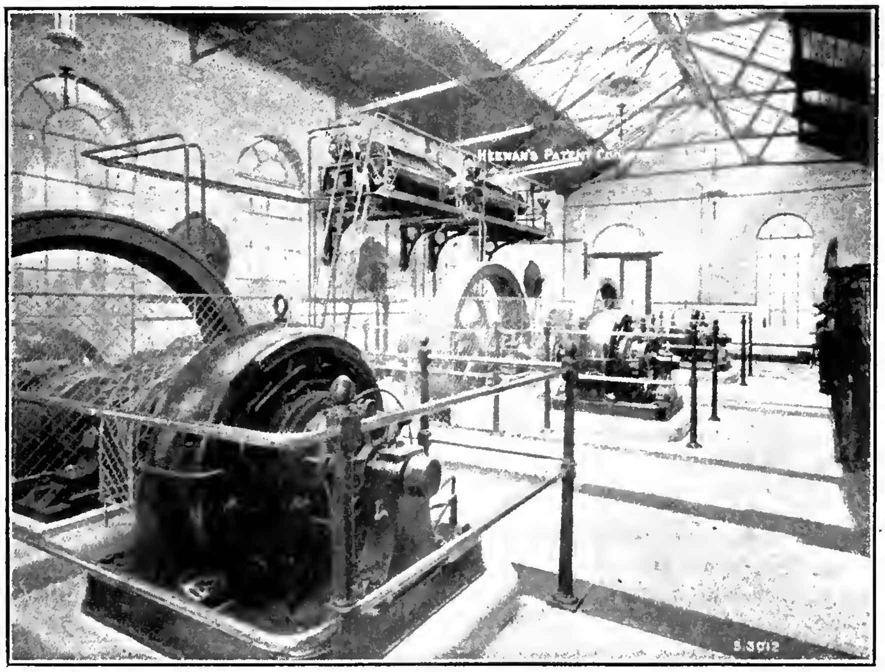


FIG. 4. TWO "HEENAN" COOLERS AT WORK IN A GAS, LIGHT AND COKE PLANT.

Various Applications.

The machines have been arranged to cool compressed air at various pressures; they have also been installed as intercoolers in compressors. The Beals system employs cooled compressed air extensively in refrigeration. The pressure is generally not much over 15 pounds. The air is used to agitate the water during the process of freezing, thus making a clear cake of ice. On board ship, the uses are also many and varied. Many trans-Atlantic liners have the coolers installed.

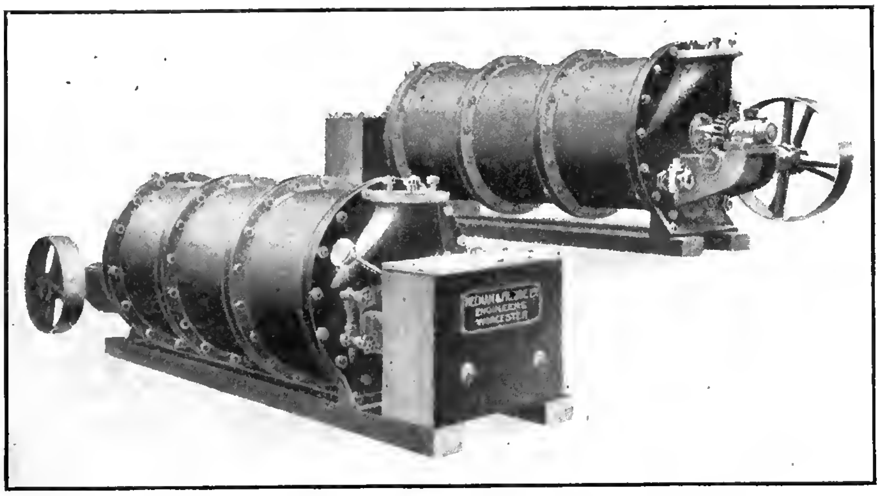


FIG. 6. TWO COMPRESSED AIR COOLERS IN ICE FACTORY.

By cooling the air, and removing thus the moisture in it, a dry blast for blast furnaces has been provided.

In chocolate factories and breweries an extensive application of these coolers has been made with excellent results. In tobacco factories the machine has been employed to produce air with a maximum of humidity, yet at the same time with no loose moisture.

In large steel mills producing forgings oil tempering is used extensively. The oil, of course, gets very warm in the course of time. Air has been introduced into it after passing through the cooler, and has been found to give excellent results.

The machine is manufactured by Messrs. Heenan & Froude, of Worcester, England, the Canadian representatives being Laurie & Lamb, Montreal.

HIGH SPEED DRILLING.

THE question of high speed drilling was discussed very fully by L. P. Alford, who read a paper on "Some Machine-Tool Developments of 1914," at a recent meeting of the Cleveland Engineering Society.

Last year, some sensitive drilling machines were put on the market, having spindle speeds as high as 10,000 r.p.m., although experimentally, drilling has been done with speeds up to 20,000 r.p.m. In the larger sizes of machines, 1 in. drills have been successfully run on tests at a speed of 12,000 r.p.m. and a feed of 1 in. per second in cast iron. (The author has seen these tests.)

In high speed drilling with numbered sizes of drills it has been found that the limit of the rate of speed is the muscular activity of the operator. Once the drill has entered, it can be pushed through as rapidly as the operator chooses to move his arm. The tendency of power feeds is toward still higher speeds for small drills than can be obtained by hand, and while the limit of speed has been frequently reached with sewing and shoemaking machines, due to lack of quickness in the operator, with machine tools the operator has always been able to keep up easily with the machine. It appears reasonable, therefore, to expect that the commonly used speeds for drilling and feeds of small drills will be greatly increased within the next few years.

The author discusses in detail the possible limitations in drilling practice. Of these, it appears that the wear of the drill is little affected, in the end, by the speed. The cutting edges of the drill are rather preserved than otherwise, at the higher speeds. As regards heating effects, it is claimed that the total heating effect at high speed is less destructive to drills than at slower speeds. The stresses on the drills are less, the drill is advancing rapidly into the cold metal and as the period of drilling an individual hole is short, the proportion of time that the drill is in the air to the time that it is cutting is increased. It appears, also, that at high speed drilling, less heat will be given to the tool by the chips than at low speed drilling. This is due to a hitherto unexplained fact, namely, that when the chips break off, they are cold and uncolored, but become hot and colored a few seconds later. This action has also been observed in milling and turning.

Harmony is a sort of an advance agent of success, and the best way for a foreman to maintain harmony is by being himself harmonious. It is not meant by this that he should be lax in exercising his authority—quite the contrary: but he can exercise it without that bulldog officiousness so repulsive to intelligent workmen.

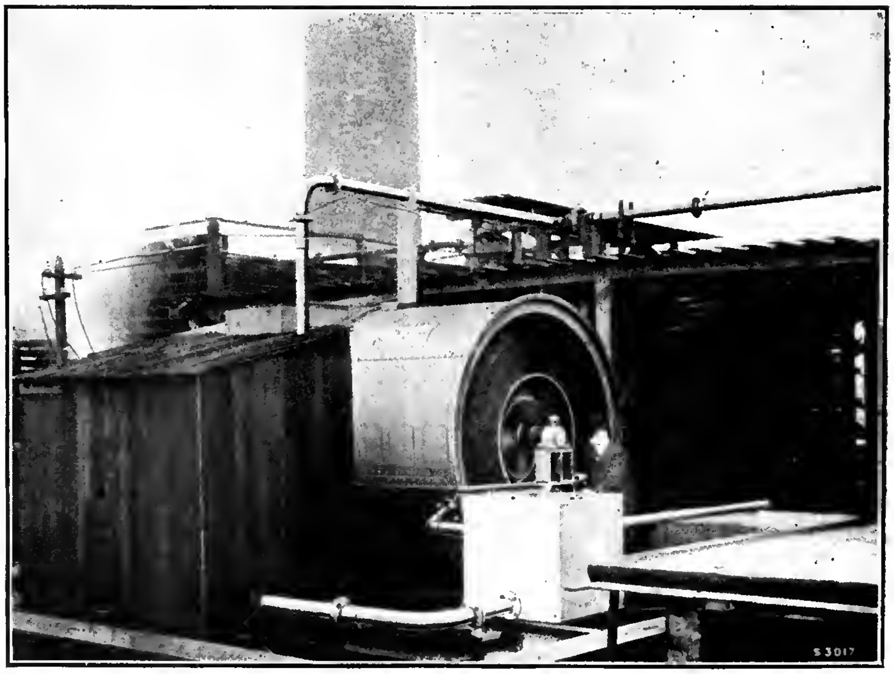


FIG. 7. "HEENAN" COOLER INSTALLED IN 200 TONS CAPACITY COLD STORAGE PLANT FOR COOLING THE CIRCULATING WATER.

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THE WAR UNIQUE IN OPPORTUNITY.

THE facts that the chairmanship of the British Government Inventions Committee was offered to and has been accepted by no less a personage than Baron Fisher indicate at once the outstanding difference between the present war and those that have preceded it.

Since the days of Napoleon, none of the wars in which Great Britain has been involved have appealed so directly and irresistibly to her people. Many of us here in Canada, who a year ago did not know the difference between shrapnel and lyddite shells are not only now familiar with these missiles in their every detail, but are in addition sufficiently well posted as to converse fluently and confidently on matters military and naval generally.

Do we pause at all to consider these changed conditions? The conduct of wars in the past was almost entirely a Government affair. The training of men, the manufacture of munitions, the procuring of stores, arranging of transport and a myriad other activities connected with campaigning, were all carried out in more or less secrecy by Government Departments; the public meanwhile acquiring their knowledge of what was transpiring through the medium of the newspapers. Information so acquired was, of course somewhat scrappy, and as a result no very keen general interest was aroused.

In the present struggle tremendous issues are at stake, and of necessity our people must not only be conversant with these but so adjust themselves as to secure for our Empire an ultimate and abundant justification reward. To this end the united efforts of our manufacturers are bent towards the production of military commodities. Every little factory with power available feels called upon to assist, all of which plainly indicates that the successful prosecution of the present grim struggle is wholly dependent on the vigorous application of the knowledge acquired in the pursuit of peace time business.

To engineers more than to the members of any other profession this war has brought opportunity, and both in the workshop and office, and in the field we believe this many-sided craft is directing its energies to produce the most effectively helpful results. By those in the field, and they are numbered in thousands it is but reasonable to expect that numerous devices, ideas and contrivances have been evolved and put into practice, the dual recommendation of promptness and suitability ensuring the necessary appreciation.

Canadian engineers although working several thousand miles away from the storm centre of the war, need not feel that distance detracts from the value of their efforts. It may be of course that some may judge us by the number of shells shipped in a given time, or by some similar numerical production basis, yet it should not be forgotten by even our smallest employer or by our humblest employee that the sum of much indirect effort may even help as much if not surpass that obtainable from a brilliant technical invention of, it may be, restricted application. Various ideas have been adopted by shell makers in performing minor operations, which, had they been proposed with all seriousness in peace time, would possibly have received scant consideration by munition experts. One instance may suffice to show how the present exigency has operated to the mutual benefit of both War Office and shell makers.

In making shells in peace time it was required that the inside of the shell be machined all over so as to ensure a uniform thickness of wall, and perfect balance. This was not specified on shells made here, but on many occasions objection was raised to the amount of forging scale on the inside. This could only be removed with difficulty and with much loss of time if attempted with orthodox appliances. A boiler tube cleaner of the centrifugal type when revolved in a suitable fixture successfully overcame the trouble, but wouldn't it have been some shock if a shell maker had informed a munitions expert that a boiler tube cleaner was increasing the output by 30 per cent.

Instances such as these are of frequent occurrence, and the free exchange of ideas between shell makers in Canada and all over the Empire is only one of many indirect efforts, the combined effect of which will not only aid in bringing the war to a desirable termination, but will establish a common bond of manufacturing interest which is certain to have a powerful influence on the recovery and further development of British Commerce when ploughshares and pruning hooks again resume their normal occupations.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey Forge, Pittsburgh	$13 20	$13 45
Lake Superior, charcoal, Chicago	.....	15 75
Ferro Nickel pig iron (Soo)	.....	25 00

	Montreal.	Toronto.
Middlesboro, No. 3	21 00	.....
Carron, special	22 00	.....
Carron, soft	22 00	.....
Cleveland, No. 3	21 00	.....
Clarence, No. 3	21 00	.....
Glengarnock	25 00	.....
Summerlee, No. 1	25 00	.....
Summerlee, No. 3	25 00	.....
Michigan charcoal iron	25 00	.....
Victoria, No. 1	21 00	19 00
Victoria, No. 2X	21 00	19 00
Victoria, No. 2 Plain	21 00	19 00
Hamilton, No. 1	20 00	19 00
Hamilton, No. 2	20 00	19 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	2.20
Steel bars, f.o.b., Toronto	2.20
Common bar iron, f.o.b., Montreal	2.20
Steel bars, f.o.b., Montreal	2.20
Bessemer rails, heavy, at mill	1,25
Steel bars, Pittsburgh	1.25
Twisted reinforcing bars	2.15
Tank plates, Pittsburgh	1.25
Beams and angles, Pittsburgh	1.25
Steel hoops, Pittsburgh	1.30
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.10
Small shapes	2.35
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.90
Structural shapes	1.95
Plates	1.95

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ¼ to ½ in., 100 lb.	$2 35	$2 25
Heads, per 100 lb.	2 55	2 45
Tank plates, 3-16 in.	2 60	2 45

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$12 50	$12 50
Copper, crucible	14 50	14 50
Copper, unch-bled, heavy	14 00	14 00
Copper, wire, unch-bled	14 00	14 00
No. 1 machine, compos'n	11 50	12 50
No. 1 compos'n turnings	10 50	9 25
No. 1 wrought iron	6 00	6 00
Heavy melting steel	5 75	6 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings	12 00	12 00
No. 1 brass turnings	10 00	10 00
Heavy lead	4 50	4 75
Tea lead	$ 3 50	$ 3 50
Scrap zinc	12 00	13 00

W. I. PIPE DISCOUNTS.

Following are Toronto jobbers' discounts on pipe in effect June 25, 1915:

	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
Standard				
¼, ⅜ in.	63	32½	....	....
½ in.	68	41½	....	....
¾ to 1½ in.	73	46½	....	....
2 in.	73	46½	69	42½
2½ to 4 in.	73	46½	72	45½
4½, 5, 6 in.	....	....	70	43½
7, 8, 10 in.	....	....	67	40½
X Strong P. E.				
¼, ⅜ in.	56	32½	....	....
½ in.	63	39½	....	....
¾ to 1½ in.	67	43½	....	....
2, 2½, 3 in.	68	44½	....	....
2 in.	....	....	63	39½
2½ to 4 in.	....	....	63	42½
4½, 5, 6 in.	....	....	66	42½
7, 8 in.	....	....	59	35½
XX Strong P. E.				
½ to 2 in.	44	20½	....	....
2½ to 6 in.	....	....	43	19½
7 to 8 in.	....	....	40	16½
Genuine Wrot Iron.				
⅜ in.	57	26½	....	....
½ in.	62	35½	....	....
¾ to 1½ in.	67	40½	....	....
2 in.	67	40½	63	36½
2½, 3 in.	67	40½	66	39½
3½, 4 in.	....	....	66	39½
4½, 5, 6 in.	....	....	63	36½
7, 8 in.	....	....	60	33½

Wrought Nipples.

4 in. and under	77½%
4½ in. and larger	72½%
4 in. and under, running thread.	57½%
Standard Couplings.	
4 in. and under	60%
4½ in. and larger	40%

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65%
Sq. Head Set Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45%
Flat & But. Head Cap Screws	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in. N.	70%
Semi-Fin. Nuts up to 1 in.	70%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

METALS.

	Montreal.	Toronto.
Lake copper, carload	$21 00	$21 00
Electrolytic copper	20 75	20 75
Castings, copper	20 50	20 50
Tin	42 00	42 00
Spelter	25 00	25 00
Lead	7 25	7 25
Antimony	40 00	40 00
Aluminum	40 00	40 00

Prices per 100 lbs.

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh	$22 00
Openhearth billets, Pittsburgh	22 00
Forging billets, Pittsburgh	28 00
Wire rods, Pittsburgh	25 50

NAILS AND SPIKES.

Standard steel wire nails, base	$2 40	$2 35
Cut nails	2 50	2 70
Miscellaneous wire nails	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	75
Stove bolts	80
Plate washers	40
Machine bolts, ⅜ and less	70
Machine bolts, 7-16 and over	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes	4¼c per lb. off
Nuts, Hexagon, all sizes	4¾c per lb. off
Iron rivets	72½ per cent.
Boiler rivets, base, ¾-in. and larger	$3.25
Structural rivets, as above	3.25
Wood screws, flathead, bright	85, 10, 7½, 10 p.c. off
Wood screws, flathead, Brass	75 p.c. off
Wood screws, flathead, Bronze	70 p.c. off

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Standard. Price. per ft.	Extra Strong. Sizes Ins.	Extra Strong. Price per ft.	D. Ex. Strong. Size Ins.	D. Ex. Strong. Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	[illegible]	[illegible]
⅜in	.06	⅜in	.07½	1	
½in	.08½	½in	.11	1¼	[illegible]
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.....
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....

COKE AND COAL.

Solvay Foundry Coke	$5.75
Connellsville Foundry Coke	4.85-5.15
Yough. Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

COLD DRAWN STEEL SHAFTING.

At mill	40%
At warehouse	40%

Discounts off new list. Warehouse price at Montreal and Toronto.

MISCELLANEOUS.

Solder, half-and-half	.26¾
Putty, 100-lb. drums	2.70
Red dry lead, 100-lb. kegs, per cwt.	9.67
Glue, French medal, per lb.	0.18
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.18
Benzine, single bbls., per gal.	0.18
Pure turpentine, single bbls.	0.66
Linseed oil, raw, single bbls.	0.67
Linseed oil, boiled, single bbls.	0.70
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Lead wool, per lb.	0.10
Pure Manila rope	0.16
Transmission rope, Manila	0.19½
Drilling cables, Manila	0.17½
Lard oil, per gal.	0.60

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto 40%

PROOF COIL CHAIN.

¼ inch	$8.00
5-16 inch	5.35
⅜ inch	4.60
7-16 inch	4.30
½ inch	4.05
9-16 inch	4.05
⅝ inch	3.90
¾ inch	3.85
⅞ inch	3.65
1 inch	3.45

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
[illegible]p to 1½ in.	60
Car[illegible] over 1½ in.	25
High Speed	40
Blacksmith	60
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Centre	25
Pipe Reamers	80

Discounts off standard list.

IRON PIPE FITTINGS.

Canadian malleable, 35 per cent.; cast iron, 60; standard bushings, 60; headers, 60; flanged unions, 60; malleable bushings, 60; nipples, 75; malleable, lipped unions, 65.

TAPES.

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3.50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$3 00	$2 90
Canada plates, dull, 52 sheets	3 25	3 50
Canada Plates, all bright6	4 40	4 60
Apollo brand, 10¾ oz. galvanized)	6 40	5 95
Queen's Head, 28 B.W.G.	6 50	6 50
Lleur-de-Lis, 28 B.W.G.	5 75	5 75
Gorbal's Best, No. 28	6 50	6 50
Viking metal, No. 28	6 00	6 00
Colborne Crown, No. 28	5 38	5 30

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$10 00	.....
1¼ in.	10 00	.....
1½ in.	10 00	.....
1¾ in.	10 00	.....
2 in.	10 50	9 20
2¼ in.	12 10	.....
2½ in.	13 05	12 10
3 in.	15 75	12 70
3¼ in.	.....	13 90
3½ in.	20 00	15 00
4 in.	25 50	18 90

Prices per 100 feet, Montreal and Toronto.

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50%
Standard	50 & 10%
Cut leather lacing, No. 1	$1.20
Leather in sides	1.10

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	$9.00
¼ in.	6.25
5-16 in.	4.65
⅜ in.	4.00
7-16 in.	4.00
½ in.	4.00

Prices per 100 lbs.

WASTE.

WHITE.	Cents per lb.
XXX Extra	0 10¼
X Grand	0 09¾
XLCR	0 09¼
X Empire	0 08½
X Press	0 07¾
COLORED.	
Lion	0 07⅛
Standard	0 06⅜
Popular	0 05¾
Keen	0 05¼
WOOL PACKING.	
Arrow	0 16
Axle	0 11
Anvil	0 08
Anchor	0 07
WASHED WIPERS.	
Select White	0 09
Mixed Colored	0 06¼
Dark Colored	0 05¼

This list subject to trade discount for quantity.

BELTING RUBBER.

Standard	50%
Best grades	30%

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Toronto, Ont., August 3, 1915.—There is little change to note as regards the general trend of business. Industrial conditions continue to show some improvement, due largely to war orders, but also on account of the beneficial effect on trade generally resulting from these orders. This war business has materially helped to minimize the depression, while the expectation of a steady volume of business of this description is helping to maintain an optimistic spirit in business circles. The first year of the war—a year without a parallel—is closing with trade conditions far better than was anticipated, say, ten months ago. In the first month or so of this period, industrial conditions were in a chaotic state, but the banks and manufacturers took hold of the situation, with gratifying results. Large orders for war equipment were placed later on, and a gradual recovery followed, which became more pronounced as the effect of these orders was felt. This is particularly noticeable in the trade returns, which now show a large increase in exports; a distinctly favorable feature. It must, of course, be admitted that the war has adversely affected some lines of business, but against this, many others have been stimulated, the manufacture of munitions being perhaps the most striking example.

Steel Market.

Conditions in the iron and steel trade continue satisfactory, due almost entirely to war business, including, of course, shell steel. The mills are actively engaged in producing forgings and bars for shells, production having increased. Reports regarding the Dominion Steel Corporation are very satisfactory, this plant operating at over 90 per cent. of capacity. The Steel Company of Canada and the Nova Scotia Steel & Coal Co. are also working to capacity on war lines.

The situation in the galvanized sheet trade is still unsatisfactory, although prices of sheets have a weak tendency on account of the decline in the spelter market. Local quotations on galvanized sheets, however, are unchanged, and there is no immediate prospect of a reduction, as spelter at the present price is too high to be on a commercial basis.

Conditions in the steel trade in the States continue to improve, and quotations on bars are holding firm. There is a large export demand for bars for shells, and inquiries also represent a large tonnage. It is reported from Buffalo that Canadian interests have been in that market recently for 3,000 tons of billets, but are unable to place the order there.

There is no improvement in the high-speed tool steel situation, as supplies of tungsten are becoming more difficult to obtain. The British Government has placed an embargo on high-speed tool steel to foreign countries; this will not, of course, affect Canada except that the demand in the Old Country is so great that the mills will have difficulty in meeting the demand here. Prices have advanced about 75 per cent., with the probability of them going still higher. This applies to American brands as well as British. Carbon tool steel has advanced slightly, but is not affected by the conditions surrounding high-speed tool steel.

Pig Iron.

The market continues stagnant, with nothing of particular importance to note. Quotations are unchanged.

Scrap Metals.

The market is keeping steady and the general situation unchanged. Quotations are holding firm except for heavy and tea lead, which have declined, and are now being quoted at 4¾c and 3½c respectively. Scrap iron is dull, but unchanged.

Machine Tools.

Inquiries continue to flow in for shell equipment, although the amount of business booked has fallen off somewhat. Dealers, however, are not complaining, and anticipate a revival in due course. Far off deliveries are inducing prospective shell manufacturers to place their orders, and in this they are wise, for the extraordinary demand in Canada and the States for machine tools is taxing the makers to the limit. It is almost a question of first come, first served. The demand for second-hand equipment is as brisk as ever, suitable tools being quickly snapped up.

CANADIAN GOVERNMENT PURCHASING COMMISSION.

The following gentlemen constitute the Commission appointed to make all purchases under the Dominion $100,000,000 war appropriation:—George Gault, Winnipeg; Henry Laporte, Montreal; A. E. Kemp, Toronto. Thomas Hilliard is secretary, and the commission headquarters are at Ottawa.

Supplies.

Business in machine shop supplies continues very satisfactory, and prices generally are holding firm. There is a good demand for lathe chucks, twist drills, high-speed tool steel, waste, cutting compound, belting, etc. The linseed oil market is weak and prices have declined 4c, oil being now quoted at 67c for raw and 70c for boiled.

ALLIES PURCHASING AGENTS.

The Trade and Commerce Department, Ottawa, has published the following list of purchasing agents for military purposes for the allied Governments:—

International Purchasing Commission, India House, Kingsway, London, Eng.

French.—Hudson Bay Co., 56 McGill Street, Montreal; Captain Lafoulloux, Hotel Brevort, New York; Direction de l'Intendance Ministere de la Guerre, Bordeaux, France; M. De la Chaume, 28 Broadway, Westminster, London.

Russian.—Messrs. S. Ruperti and Alexsieff, care Military Attache, Russian Embassy, Washington, D.C.

Metals.

There are few price changes to note this week, and the market generally is dull. The tin market continues to decline, due to weakness, in London. The copper market is very dull, but quotations are unchanged. The spelter market is easier and lead unsettled, while antimony is very dull. The demand for metals for munitions is brisk, and ordinary business is gradually improving.

Tin.—The market continues to decline in London, due to lack of support. The New York market, however, is comparatively steady. Business continues dull, with little demand for spot tin. Tin has declined 2c, and is being quoted at 42c per pound.

Copper.—The market is very dull and prices are unchanged. It is reported from New York that the actual business placed both for home consumption and export during the month of July has probably been less than for any other month this year. Copper is quoted locally at 21c per pound.

Spelter.—Good business is reported for all deliveries, but buying is almost entirely on account of war orders, both directly and indirectly. The market has an easier tone, but qnotations are unchanged and nominal at 25c per pound.

Lead.—The market is weak, and it is probable that the "Trust" will reduce their quotation from 5.75c, New York. Local quotations are unchanged at 7¼c per pound.

Antimony.—The market is very firm, and makers are almost in a position to demand their own terms. There is no likelihood of any excessive supply of raw material becoming available. Quotations are nominal and unchanged at 40c per pound.

Aluminum.—The market is firm and the price unchanged. Local quotations are nominal at 40c per pound.

BIG INCREASE IN EXPORTS.

THE anniversary of Great Britain's declaration of war directs attention to Canada's accomplishments and some of the more outstanding results of the conflict as affecting this countrry.

The initial step, taken before the formal declaration of war was the offer by the Prime Minister of military assistance in the event of hostilities. Immediately after the war broke out, a complete Canadian division was accepted and hurried mobilization and equipment arranged for. It started on the 25th September, 1914, wintered at Salisbury, and in early spring went to France. The story of St. Julien, Ypres, Festubert, and Givenchy speaks of the character and the results.

70,000 Are Overseas.

Since then there has been more and steady recruiting, till about 140,000 men have been enlisted. Of this number upwards of seventy thousand are now overseas. Reinforcements are going ahead constantly. It is the intention to maintain in the field two complete divisions, and a third one may, quite possibly, be put there. In fact, there is no telling to what extent Canadian resources of men and munitions may be

drawn on. A Russian retirement in the east and the return westward of German hordes might easily produce conditions calling for much greater assistance from this country than has heretofore been thought necessary.

Exports Have Increased.

The war has interfered with trade, and has completely changed the balance of it, so much so that last month the figures of export exceeded imports by thirty-five millions. Import trade has dwindled materially, while exports, raw and manufactured, have much increased. While many lines of business have been adversely affected, the war has stimulated industry connected with munitions and equipment for the forces.

An estimate of war orders in Canada places the total at approximately three hundred and fifty million dollars. This includes orders by the Canadian and allied governments. Orders for shells alone are estimated at one hundred and fifty-two million dollars. About 160 factories are turning them out.

Revenue Goes Up.

The revenues which immediately started to decline after the war, were not very successfully arrested by the taxes imposed at the special session of Parliament in August. Those adopted by the last budget, however, have caused the revenue since then to equal and in most cases exceed what it was in the ante bellum months of last year. The war is being financed by British loans, while public works are being carried on by loans from Britain and the United States. The small jobs have been shut down, but the big undertakings are all going ahead. This policy has been followed from the start.

Canada has spent nearly a hundred millions on the war. It costs three hundred millions to run the country this year, and of this amount the war is costing half a million a day. The big item of outlay is the pay of officers and men. On equipment, about thirty millions has so far been spent. Speaking financially, while money is available for war purposes, municipal corporate or individual borrowings have been greatly restricted. There is no prospect of the flotation of a loan in Canada for the reason that all the money available is needed for commercial domestic purposes.

Recruiting.

Just at present efforts are being concentrated upon recruiting of the new regiments and their equipment. The work has gone ahead spendidly, but the figures of enlistment in the past month admit of improvement. This applies to all military divisions, but it is quite probable that harvesting activities have much to do with the situation, and that when they are finished, enlistment will rapidly be augmented.

MORE TONNAGE NEEDED.

THE Dominion Government is investigating the situation as regards the scarcity of Canadian tonnage, with a view to alleviating conditions in anticipation of the movement of the wheat crop. Representations are being made to the Imperial authorities and will be supplemented with information as to the increase in tonnage necessary to carry the crop without dislocating Canadian trade in general.

So far there has been no definite outcome of these negotiations. It has been represented from time to time that prize vessels captured from Germany and Austria should be placed in the mercantile service, but so far the Imperial Government have not consented. It is understood that this is one of the questions which Sir Robert Borden is taking up with the authorities in England, although there is no truth in the report that the Premier is arranging for the taking over of the Canadian crop.

THE ATLANTIC IN WAR TIME.

IN the harbor at St. John or Halifax, according to the Canadian Gazette, may be seen a number of the old square-rigged Canadian sailing vessels loading up for England. These relics of the nautical past are helping to fill the gap made by "orders of the Admiralty" in the ranks of the regular cargo boats. There is money in the business. British importers of Canadian timber, for instance, have now to pay £6 10s. per standard of 165 cubic feet for freight from St. John to Old Country ports.

One old "tub," to use the irreverent phraseology of the modern gold-laced officer in the merchant service, was sold not dong ago for $8,000. In one trip alone this same "tub" is said to have cleared $12,000 profit! An iron sailing vessel that cost $25,000 is said to have made $35,000 on its first trip across the Atlantic. Old "salts" who have been living on shore for many years have again donned their oilskins. A boot and shoe merchant, who had not sailed a ship for twenty years, sold his store, bought an interest in a brig, skippered it himself across the Atlantic, and cleared up $3,000 in a month. No more boot selling for him, he declares. The Atlantic is an interesting highway these war days!

Vibration is the chronic enemy of machinery, so seek to guard against it in every practical way.

CANADIAN SHIPBUILDING IN 1914.

ACCORDING to the list of vessels built and registered in Canada as issued by the Department of Marine and Fisheries, 1914 was a fairly active year in ship construction. In the '70's of last century, when the wooden sailing ship was still the glory of the seas and a main carrier of ocean-borne commerce, the measurement of vessels turned out of Canadian yards ran up towards 200,000 tons a year.

The steel tramp that on a low consumption of coal could push its way through the water at a speed of eight miles an hour or so was getting its start, however. It was better adapted to the needs of a growing commerce, and if on the ocean highway it could not keep up with the fine clippers and great three and four-masted sailers, it had other advantages which made it the fittest, and its old-type competitor could not survive. From 1874, when 190,756 tons was added to the registry, there was a gradual decline till 1896, when the additions to the list only measured 16,146 tons.

When the development of trade on the Great Lakes began to call for a larger class of steamers than had heretofore been employed, Ontario began to advance as a ship-owning and ship-building province, and has of late years been the chief contributor to the record. Last year the measurement of the new vessels was 43,346 tons, the largest figure in fourteen years; and of the whole, 23,167 tons was credited to Ontario.

The increase in the total of vessels registered was, however, only 35,457 tons, there being a reduction on account of the loss, sale or breaking up of older craft. According to the record the number and tonnage of vessels registered in Canada at the close of 1914 was as follows:

	Vessels.	Tons.
Ontario	2,100	314,660
Quebec	1,663	259,143
British Columbia	1,591	147,192
Nova Scotia	2,098	135,053
New Brunswick	1,052	55,522
P. E. Island	149	10,029
Manitoba	103	7,999
Yukon	11	2,295
Saskatchewan	5	529
Total	8,772	932,422

The average size of the registered vessels, it will be noted, is just over 100 tons. There are ships of large capacity on the list; but the majority are schooners or fishing barges, and even smaller craft, that some countries do not enter on their records of ships. They all serve a useful purpose, however, and play their part in the work of transportation of one kind or other.

Trade Gossip

The Collingwood Shipbuilding Co., Collingwood, Ont., have closed a contract with the Imperial Oil Co., for a steel tank steamer of the same type as the one now under construction for the same concern.

Toronto, Ont.—Delivery of the machine guns which Ontario is supplying to the Canadian forces at the front will begin October 30, when ten will be put in the hands of the militia department. More will be delivered weekly till December 18, when the last 130 of the 500 are due from the contractors.

Conditions Better in Steel Business.—Conditions are better than for the past three years, said J. H. Plummer, president of the Dominion Steel Corporation, who was in Montreal recently. He also said that many of the difficulties to which he referred at the annual meeting, had been overcome, though there was still some slight difficulty in securing tonnage to England.

Hydrographic and Biological Survey. The Marine Biological vessel, the Prince, has left to continue hydrographic work in the Bay of Fundy. The party consists of Dr. Cox and Messrs. Craigie, Chase and McMurrich, and will be gone about a fortnight. They will proceed to St. John, run a line of stations to Digby; thence up Annapolis Basin to Annapolis. Returning, they will run another line from Quaco to the Nova Scotia coast opposite: besides working a few midway the Bay on the return trip.

Make German Dyes Here.—Two Canadian companies are grasping the opportunity offered by the failure of German concerns to furnish dye stuffs to America. The last issue of the Quebec official gazette, announced the incorporation of the two new companies that will produce the dye stuffs. The Berman Dye Works, Ltd., of Montreal, is empowered to carry on the business of dyers and are also empowered to produce all necessary products for their industry. The Weedon Chemical Co., among its powers, has been given that of distilling wood and producing all sorts of chemical products.

Newfoundland Buys Guns.—The Newfoundland regiment has already two machine guns, the gift of Mr. William Duff Reid, president of the Reid Railway concern. Sir Edgar Bowring, president of the Bowring Bros. Steamship Co. has announced the gift of two machine guns from his company. The employes of Harmsworth Paper Mills at Grand Falls, in the interior of Newfoundland, will provide two more machine guns, and the employes of the Dominion and Nova Scotia Steel Co.'s mines at Wabana are each pledged for one thousand dollars, which will be devoted to machine guns also.

Machining Shrapnel Shells in a Steel Foundry Plant

Staff Article

Resourcefulness in gripping and mastering the details of shrapnel shell manufacture has not, as will have been noticed from our leading articles in this and recent issues, been confined to any particular section of Canadian mechanical engineering enterprise. The plant here featured, although not a leader in point of size, earns that distinction in its output.

THE conversion of a steel foundry, into a machine shop requires the exercise of considerable ingenuity, and in the case of the plant under review, it would be difficult to imagine that it had been anything else but a machine shop. At this plant both 15 and 18 pounder shrapnel shells are being produced, this article will, however, describe the manufacture of the latter only. There is, however, practically no difference between the two as regards their manufacture, except in less important details, such as cutters and inside tools, which are necessarily smaller for the 15 pounder shells. The same machines are used and the same sequence of operations for both calibres. A description covering the manufacture of 18 pounder shrapnel shells will, therefore, cover the 15 pounder also. The number of 15 pounder shells which have been manufactured is insignificant when compared with those of the larger calibre.

As the equipment was installed solely for the purpose of making shells, it was possible to make the layout to suit the sequence of operations. This feature in itself saves a lot of time and labor in handling the shells and also materially serves to increase production. Although some of the machines are not new, efficient tooling has produced very satisfactory results. This is particularly true as regards the air chucks which are fitted to some of the machines. They are quick-acting, and thus save a lot of time where otherwise much is lost.

Cutting off Shell Forging.

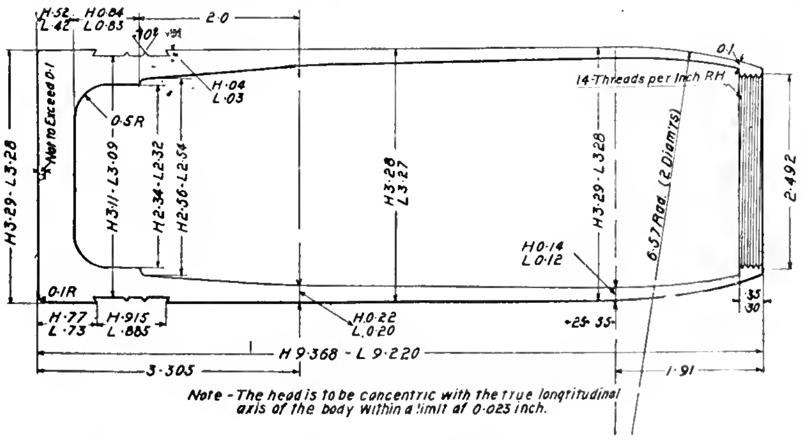
The first operation follows the practice adopted in the majority of plants and consists in cutting off a part of the open end of shell, which is of course ragged, sufficient metal having been left on for cleaning up. A cutting off machine supplied by the F. E. Garvin Co., New York, is used for this work. The shell case is secured in a chuck, the correct position being determined by a hook ended gauge, the straight end resting on the bottom of the shell inside, while the hooked end curves over the mouth of shell and marks the point where to start the cut. An ordinary parting tool mounted in a tool holder on a cross slide at the side cuts off the shell end.

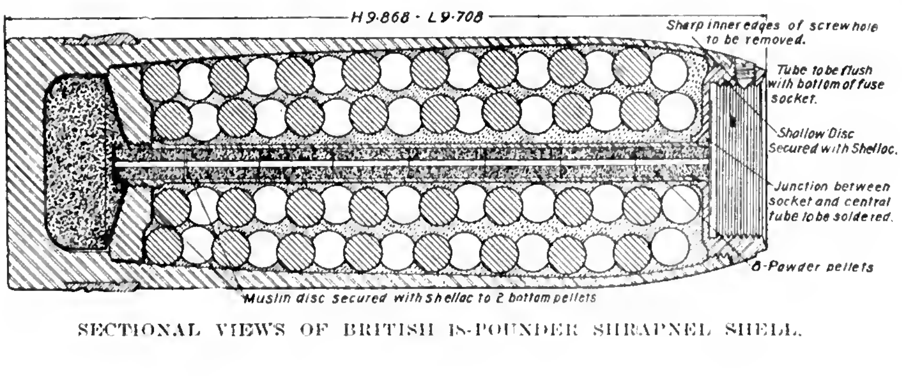
Centering.

The shell casing is not perfectly concentric and this defect has to be guarded against in subsequent operations. To reduce the possibility of error from this cause the base of shell is centered, the center being retained until all machining operations on the shell body have been completed; thus the shell revolves about the same centre during all the operations. The centering is done on a "Bertram" turret lathe equipped with an expanding mandril, while on the turret is mounted a small countersink drill for forming the centre in the base. By this method the centre of the base is true to the inside of the shell, which it will be remembered is not yet machined; therefore the outside when turned up will be concentric with the inside of shell.

Rough Turning Outside Shell.

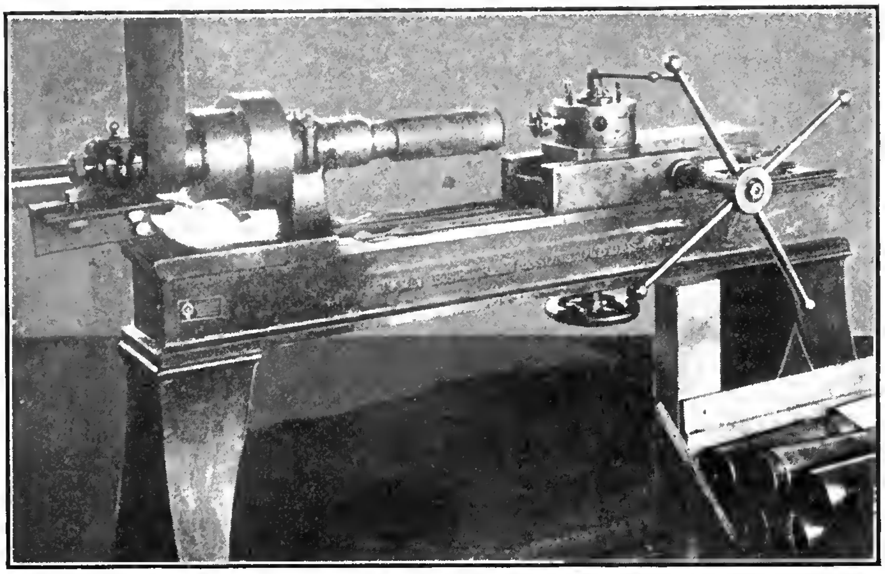
The shell case is next rough-turned





SECTIONAL VIEWS OF BRITISH 18-POUNDER SHRAPNEL SHELL.

on an engine lathe built by the R. McDougall Co., Galt, Ont. The lathe is equipped with a short taper mandril instead of the usual chuck. The mandril has 3-taper steel bearing surfaces over which the shell is forced a sufficiently tight fit, while the hollow centre at the base end engages with the tailstock centre. This arrangement permits of the entire length of shell body being machined. The bevel on outside of nose is taken care of by a cam device attached to the bed of lathe at the back. The cross slide has an extension with a roller at the end engaging with the cam, thus giving the required bevel and preparing the nose for the closing in operation at a later stage.



COUNTERSINKING CENTRE IN SHELL BASE.

Rough and Finishing Boring Inside.

At the next operation the shell casing is rough bored and finished inside, also faced to length. A. Walcott & Wood combination engine and turret lathe is used for this work, the lathe being fitted with an air chuck designed by the Electric Steel & Metals Co. of Welland, Ont. The air chuck is of the same type as fitted to the lathe for machining and threading the nose, and will be dealt with later, when that operation is being described. The turret holds four tools, the first being a boring bar with a cutter, and the second, a large drill. Both these tools are used for the same purpose, viz., to remove any scale that may be in the forging. The third turret face holds a bar with a cutter for rough boring the inside of the forging, the end of the cutter being shaped to conform to the profile of the inside of base. In the bar is an inserted cutter for facing the forging to length. The fourth tool is similar to the preceding one and is used for finishing the inside and base profile. The bar has at its base a collar stop gauge for regulating the depth of cut at the base inside.

Rough Facing Base.

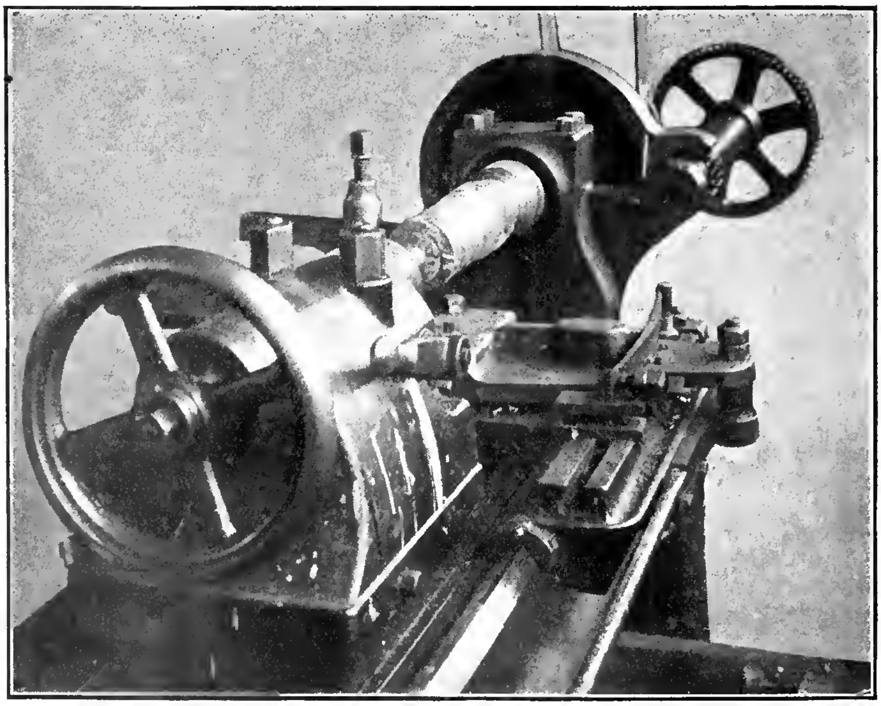
The next operation consists of rough turning the base of shell which up to this point has not been machined. In some plants this is usually the second operation. A cutting off machine built by John H. Hall & Sons, Brantford, Ont., is installed, and is equipped with back and front tool holders mounted on separate cross slides, but operated by the same spindle which is threaded right and left hand, so that both tools feed in towards the centre at the same time. The back tool is set ahead of the front, the cut thus being equally divided. Sufficient metal is left to form the centre already referred to. The shell is secured in a universal chuck while inside the hollow mandril is a fixed stop for locating it, the end of stop resting against the inside of base of shell.

Finish Facing Base.

At the next step, the base is finished except that the centre is left on. This work is performed on a turret lathe supplied by the A. R. Williams Machinery Co., Toronto. The shell is held in a two-jaw chuck and is set in the correct position by means of a bar in manner similar to the preceding operation. On the turret is mounted a fixture with three rollers for holding the base of shell, a broad cutter for facing up the base, and a smaller cutter at the side for rounding off the corners. A stop device under the turret regulates the feed.

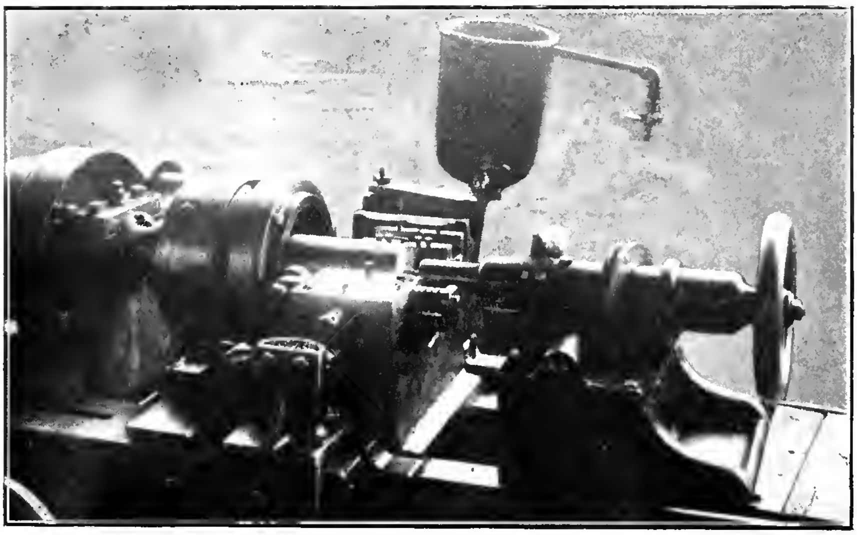
Machining Driving Band Recess.

The copper driving band recess is now machined on an engine equipped with a "Bertram" waving and dovetailing attachment. The lathes were supplied by the Stevens Co., of Galt, Ont., and the A. R. Williams Machinery Co., Toronto. The nose end of shell is held in a universal chuck to which is attached a three-point cam for forming the wave. The centre on base of shell, which by the way has not as yet been cut off, engages with the tailstock centre. The front and back tool holders are mounted on separate cross slides, both being on a fixture fastened to the lathe bed. The front or waving tool



ROUGH TURNING OUTSIDE OF SHELL BODY.

holder has in addition a slide to permit the necessary lateral motion. Fastened to the saddle are two brackets at the back and one at the front, each bracket having a cam on the inside for feeding the tools during the operation.



GROOVING AND WAVING COPPER BAND RECESS.

The front tool holder contains a bar having at one end a roller and also the waving and grooving cutters. A strong spring on the outside holds the roller against the face of the cam. The dovetailing fixture at the back has two hook-nosed tools, left and right hand, secured in holders working in diagonal slides to form the undercut or dovetail. In operation, the tools being in position with the roller against the cam, the saddle travels in a direction away from the chuck, bringing the cams up to and at the back of the tool holders and forcing them in gradually, thus machining the groove to the required form and size. As regards the front tool holder, the cam presses on the lower part of the fixture, thereby leaving the tool holder free to oscillate while forming the wave lines and cutting the groove which is done by the same tool. This is the last machining operation previous to the heat treatment.

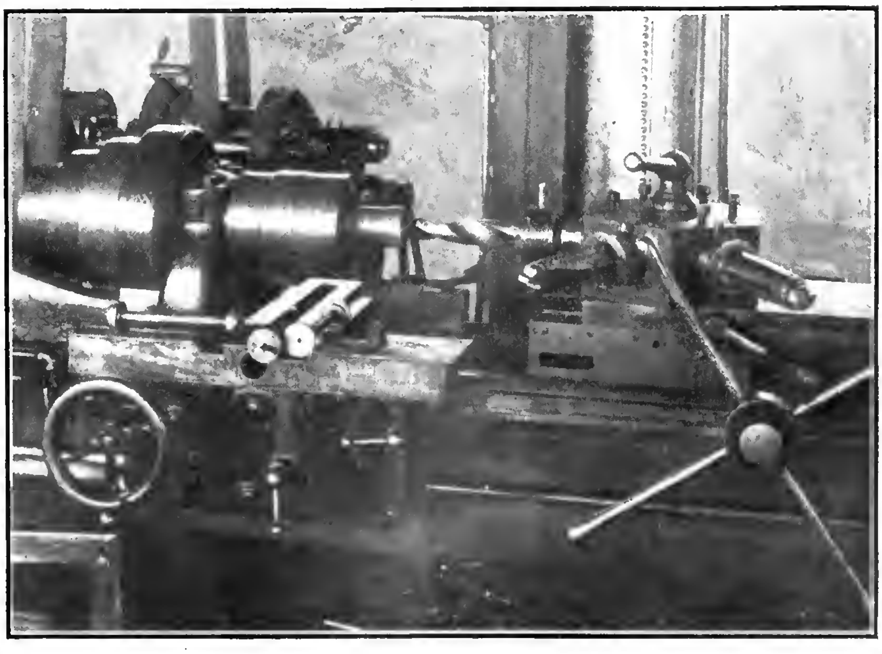
Heat Treating.

The important operation of heat treating now follows, in which the shell is brought to the required tensile strength. In this particular plant there are three distinct heatings. In the first place the shells are pre-heated in a gas furnace, constructed of brick and shown in the foreground in the illustration. The object of the pre-heating is to obviate the molten lead being cooled too much during the hardening process which follows. In the pre-heating furnace the shells are brought to a dull red and are then immersed for one minute in molten lead, the furnace temperature of which is at 1,575 degrees Fah. The shells are next dipped in an oil bath, taken out and cooled. At this stage the degree of hardness indicated by a test on a "Shore" scleroscope is around 55.

The drawing or tempering process now follows. The shells are put into another furnace also containing molten lead as a heating medium for 5 seconds, the temperature being 1,050 degrees Fahr. They are then taken out and allowed to cool gradually. The degree of hardness after tempering ranges between 41 and 45.

The furnaces are heated by natural gas, one being shown to the right of the pre-heating furnace, the others being behind. The oil quenching tanks are also on the right hand of the furnaces. The oil tanks have a water jacket to cool the oil and are equipped with a device for forcing air, from an adjacent compressor through the oil to keep it in motion and so to assist in the cooling process. Two electric pyrometers supplied by the Canadian Hoskins Co., Walkerville, Ont., are installed in this department for indicating the temperature of the various furnaces.

When cool the shells are arranged in lots of 120 in racks or boxes according to their series, a few of each lot being selected at random to undergo the test for hardness on a "Shore" scleroscope. Each shell has up to this point had a heat number stamped on, but after being tested they are identified by means of the series number; a record, however, is kept of the heat number. Before being tested, each shell is cleaned at the "set-up" point by means of a wire brush, in order to remove scale and have a clean surface for testing. A full description of the Shore scleroscope is unnecessary at this juncture, it being sufficient to say that a number of readings are taken, the shell being moved around on the carrying block between each test. A record is made of the average reading and one shell is selected from the series in order to provide a test piece which is cut at the set-up point. This is formed to suitable shape and is sent off to be tested by a government inspector who ascertains its tensile strength. The connection between the scleroscope readings and the tensile strength is that they bear a definite relation to each other, the degree of hardness being proportional to the tensile strength of the metal.



ROUGHING AND FINISHING INSIDE OF SHELL BODY AND FORMING OUTSIDE NOSE BEVEL.

Closing in the Nose.

The hydraulic press will be noticed on the right hand of the illustration.

This was built by Wm. R. Perrin & Co., Toronto, who also supplied the triplex pump and accumulator for operating it. The nose of the shell is first heated to a nice cherry red in a gas heated furnace containing lead, the latter being similar in construction to those already described. The diaphragm is dropped in and the shell is placed base down on a fixture attached to the table above the ram, the fixture having two vertical guides for keeping the shell central. When the pressure is applied, the ram rises and forces the nose of shell into the cone-shaped die in the casting above, thus closing it in to the correct size and profile. The press exerts a pressure of 1,000 pounds for this operation. The die is cooled from the water tank shown on top of the press. The shells are allowed to cool slowly and are then removed for the next machining operation.

Machining and Threading Nose.

This operation consists of facing the shell to length, reaming out preparatory to threading, finishing nose profile outside and inside, and threading the nose. A number of engine lathes built by the London Machine Tool Co., of Hamilton, Ont., are employed for this operation, each lathe having a turret mounted on the saddle and being tooled up to suit the work. An interesting feature to be noted is the air chuck which was specially designed for this class of work. The chuck proper consists of a circular casting or hood bolted to the driving plate and contains three jaws inside for holding the shell. At the back of the jaw is a plunger operated by a spindle inside the headstock and connected to the air cylinder at the extreme left hand of the latter. The shell being placed in the chuck, and the air admitted to the cylinder, the plunger forces the jaws forward, grasping the shell securely.

The first turret face holds a reamer with a stop bar projecting in the centre to give the correct length to the shell when the small cutter at the side of the reamer is in operation. The reamer prepares the nose for threading. At the second turret face is a bar with a broad curved cutter for making the finishing cut to the nose profile outside. The third turret face holds a bar with a similar cutter, but curved to suit the inside profile of nose. This cutter cleans up the inside of nose profile at the back of the part to be threaded. A "Murchey" collapsible die is mounted on the fourth turret face for threading the nose. This operation completes machining on the inside of shell. The gauges used in this operation are shown on the lathe saddle in the illustration.

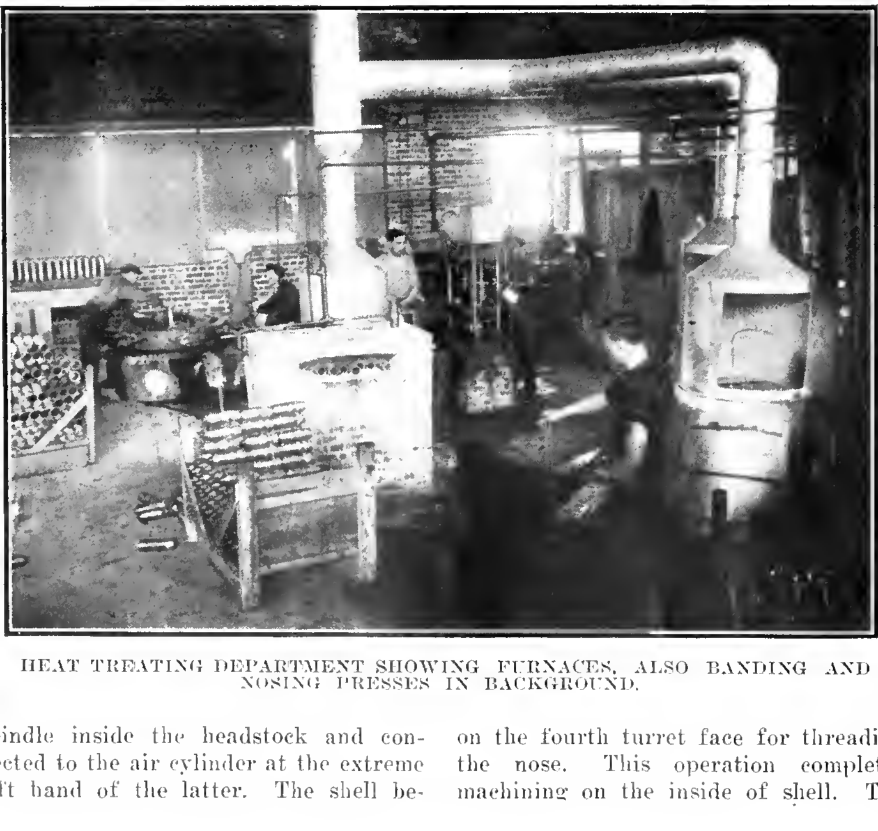
BANDING AND NOSING PRESSES AND ACCUMULATOR.

Finishing Outside Body.

Alternative methods are used for this operation, the shells either being turned on an engine lathe or finished on a grinder. For the first mentioned method an engine lathe built by the F. E. Reed Co., Worcester, Mass., is used. There is no cam attachment used in this case as it will be remembered that the nose profile has already been finished, thus the straight part of the shell body only requires machining or grinding as the case may be.

For the machining operation a plug centre is screwed into the nose of the shell and placed on the live or headstock centre of lathe, the base centre engaging with the tailstock centre. One light cut is only necessary to finish machining the body of shell, and this is done by an ordinary turning tool.

For the grinding operation a 10 x 24 in. plain grinder built by the Landis Machine Co., Waynesboro, Pa., is used. As in the preceding case the straight part of the shell only is finished and a "Hart" emery wheel is used for the purpose. The grinder is belt driven from a motor located on the floor at the back of the machine, a satisfactory arrangement considering the nature of the work. For grinding the shell, the same type of centre is used for the nose end as for the machining operation. The base end of shell is carried in a cup centre. About 1-32 in. only is removed when grinding.



HEAT TREATING DEPARTMENT SHOWING FURNACES, ALSO BANDING AND NOSING PRESSES IN BACKGROUND.

Pressing on Driving Band.

It will be noticed in the illustration that there are two banding presses. The press in the foreground was built by the Goldie-McCulloch Co., Galt, Ont., and is for the 18 pounder shells. The press immediately behind is for the 15 pounder shrapnel shells and was built by the Canadian Fairbanks-Morse Co.,

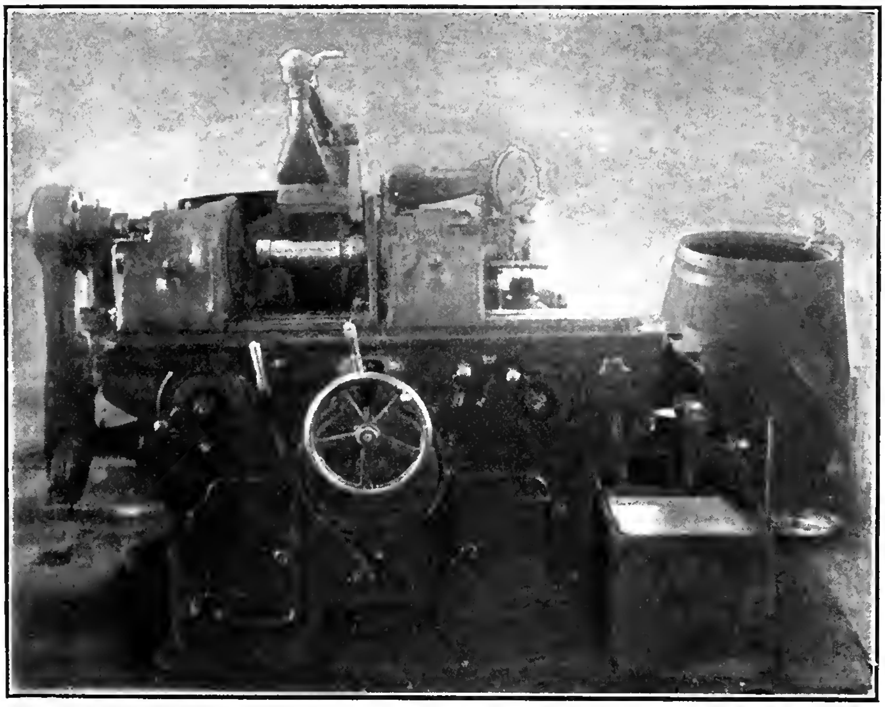
Toronto. They are both very similar in construction, each having six hydraulic cylinders with rams converging towards the centre at the end of which are steel dies conforming to the shape of the rough copper band. Both presses are operated from one pump and accumulator built by Wm. R. Perrin & Co., Toronto. The pump is located behind the accumulator and the press will be seen to the right in the illustration.

The method of operation is the same for both presses. The copper band is slipped over the base into the recess, the shell being then placed on a plate in the centre of the press. The operator moves a lever and the rams squeeze the copper band into the recess. The pressure is now taken off and the shell given a slight turn, after which the operation is repeated, thus equalizing the pressure on the band. The copper band now completely fills the recess and the shells are removed to have the bands turned.

Turning Copper Bands.

The copper bands are turned on a machine built by the Jenckes Machine Co., Sherbrooke, Que. This is equipped with a universal chuck mounted on the headstock spindle which is driven by friction clutch pulley controlled by a lever within reach of the operator. On the bed of the machine is clamped a saddle which carries the front and back tool slides.

The shell is placed in the chuck and is located in the correct position, by a swinging finger pivoted on the front tool block, before the chuck is tightened. The front or roughing tool is held in a holder working on a cross slide on the fixed saddle. The tool is fed in by a hand wheel to a dead stop. The front tool holder is provided with a hinged scraper rest for removing the ragged edge at each side of band after tooling. The rear or finishing tool is held in a steel block working in a slide on a fixture on the saddle at the back. The tool is mounted above the work, but can be adjusted to pass down behind the work, and in passing shave the band to size. The feed on the back tool is controlled by a lever and pinion.



"LANDIS" GRINDER FINISHING SHELL BODY.

FINISHING AND THREADING NOSE INSIDE. FORMING NOSE PROFILE OUTSIDE.

Removing Centre and Marking.

The centre projecting from the base has up to this stage been retained and used in the various machining operations, this method being adopted, as already stated, in order to obtain a shell as concentric as possible, for by always working from the same centre, this can more easily be accomplished. As there are now no more machining operations on the shell proper, the centre is cut off. This operation is done on a lathe supplied by the London Machine Co., Hamilton, Ont. The shell is now ready for marking, and for this operation is taken to a bench where the various markings are stamped on by hand.

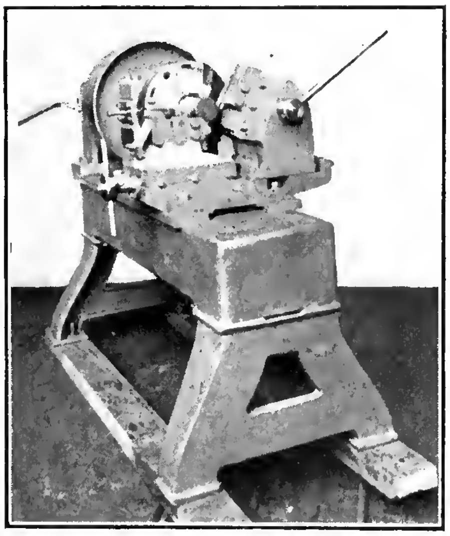
Filling and Assembling Shells.

The shells go next to the assembling department where the various parts are put together and the bullets and resin poured in. The tin powder cup is first slipped past the diaphragm into the powder pocket, and the brass fuse tube screwed into the diaphragm. For pouring in the bullets, a wooden structure has been devised, this consisting of a bin containing the bullets situated above the operator and supported on a frame. The bullets fall down a spout into a receptacle which tilts when it contains the approximate total number, the latter pouring into the shell which has been placed underneath. To help the bullets to consolidate in the shell an air jarring apparatus is used which vibrates the shell while the bullets are being poured in. The shells are now taken over to a resin kettle where hot resin is poured in to form a matrix for the bullets. Immediately afterwards the shell is weighed

and the weight adjusted within the prescribed limits. In order to obtain the correct weight, it may be necessary to add a few buckshot or take out a little resin. The brass socket is next screwed into the nose, and the fuse tube soldered in the hole in the socket.

Finishing Sockets.

When the brass sockets are received at the plant they are already machined and threaded except for that part outside which forms the fuse plug seat. A "Bertram" engine lathe with turret attachment is employed for machining this. The shell is chucked, and the outside of the socket rough turned, the bar with cutter held in the second turret forming the fuse plug seat on the outside of the socket. The third tool faces up the bottom of the socket at the same time, removing that part of the fuse tube which projects after soldering. The brass socket is now hand tapped, and the shells cleaned and weighed so as to be ready for the final Government inspection. During this they are carefully weighed and gauged, and one selected out of each series for the firing test. Before being taken to the painting department, a brass plug is screwed into the nose. These plugs, as in the case of the sockets, are made outside, and do not require any further machining.

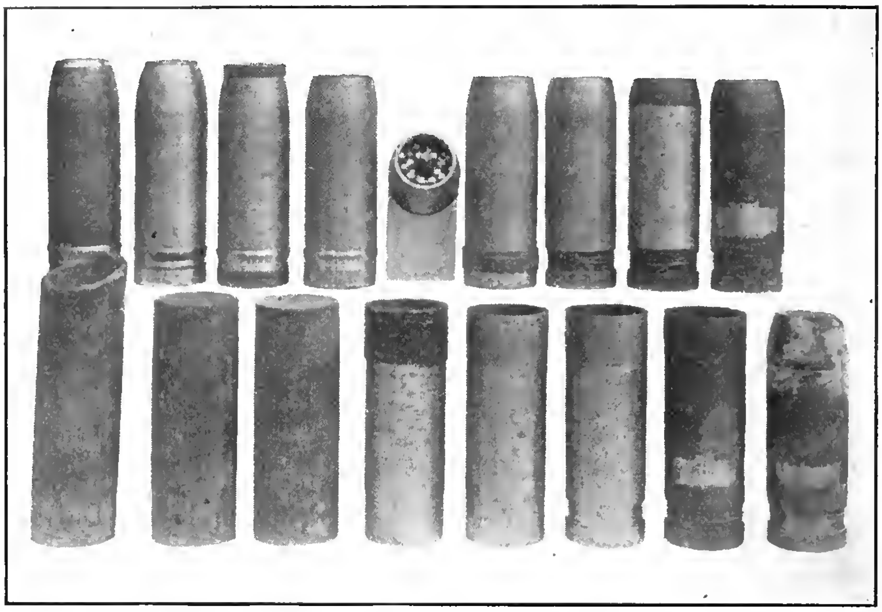


JENCKES MACHINE CO. BAND TURNING LATHE.

Painting.

The accompanying illustration shows the painting and shipping room. The painting machine is a portable outfit, and consists generally of a motor which drives three cup-shaped shell holders located on the top of the table. The motor is situated below, as shown. The priming coat is of course grey, the finishing coat black, and the nose red; the paint is applied by hand. It will be noticed in the illustration that the shells on the floor are arranged in their series, the packing cases being seen at the left.

No particular reference has been made to the gauging feature which plays a most important part in the manufacture of any type of shell. The gauges used are standard, and are as used in most plants making shells. At each operation the shells are carefully checked with high and low gauges, and, in addition, inspectors specially appointed examine each shell at certain stages of manufacture.



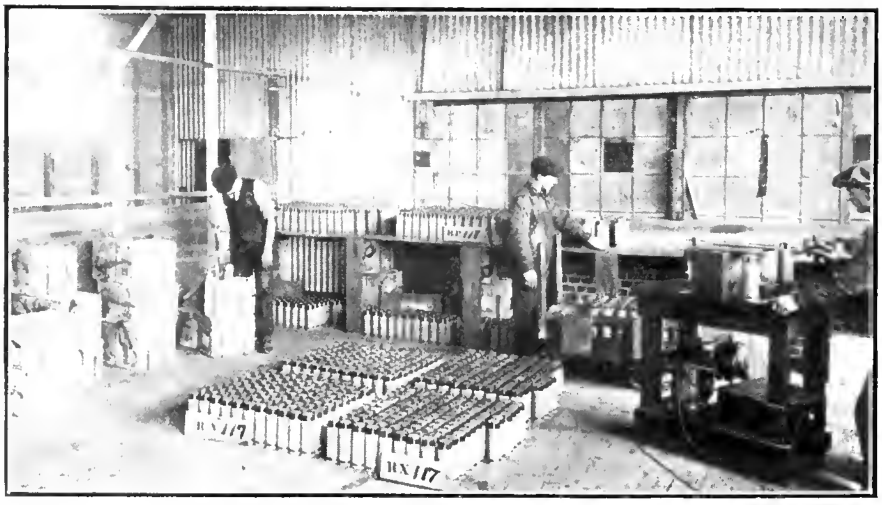
SHRAPNEL SHELLS IN VARIOUS STAGES OF MANUFACTURE AFTER WHICH THEY ARE READY TO BE MADE IN "FIXED AMMUNITION."

ELECTRIC FURNACES.

THE principal advantages to be derived from the use of electric furnaces in preference to combustion furnaces for reheating in steel works are summarized by T. F. Bailey as follows:—"More accurate temperature control; non-oxidizing atmosphere; saving in space; elimination of blast and stack; uniformity of temperature throughout the heating space; simplicity of control; smaller amount of heat lost to the surrounding atmosphere; and cleanliness of surroundings. The smaller amount of heat lost to the surrounding atmosphere makes the work around an electric furnace far more healthy and agreeable than with the combustion furnace."

For furnace temperatures not exceeding 2,500 deg. Fahr., the electric furnace will answer any reasonable requirements, and so far as the actual fuel cost alone is concerned, at the rate of one cent per Kilowatt-hour, will compare favorably with oil furnaces burning oil at four cents per gallon.

The modern idea seems to be that as such a large part of our life is spent in the occupation of business, it ought to be one of pleasant relations and enjoyable conditions. These are possible only as justice, good feeling and honesty prevail.



PAINTING DEPARTMENT AND SHIPPING ROOM.

The Design and Constructional Features of Plug Gauges--II.

By C. Hattenberger

The application and maintenance of proper plug gauges for certain lines of manufacture mean greater efficiency and interchangeability. Where a large number of similar pieces are required, suitable gauges are most essential, and should be provided.

ADJUSTABLE PLUG GAUGE.

FLAT gauges are frequently employed because of their light weight. In some cases they are the only gauges that can be used at all, because cylindrical gauges of the same size would be too cumbersome. Fig. 23 shows an adjustable gauge. The frame (A) is an aluminum casting, having holes drilled to receive the screws for holding the hardened measuring blocks (B). When the gauge shows wear, it is only necessary to disassemble and reduce the thickness of the shims (C), after which it can again be assembled and ground to size on centres provided for the purpose in the frame.

Fig. 24 shows an inexpensive form of flat plug gauge limit type of go and not go ends and exact size in the centre.

A plug gauge that can be used without drawing the boring bar from the hole is shown in Fig. 25. The illustration, the writer believes, is self-explanatory.

Ball Race Gauges.

Fig. 26 shows a gauge used for gauging ball races. It consists of the following: A sliding plug (A), having the proper limits; these, for obvious reasons, are shown exaggerated in the illustration. The spider (B) is milled and drilled to receive the oscillating fingers (C). These are held against the plug by means of helical springs shown. The measuring points (D) are lapped to the proper length and radius, and should be a tight fit in part A. A small stud (E) governs the movement of the sliding plug.

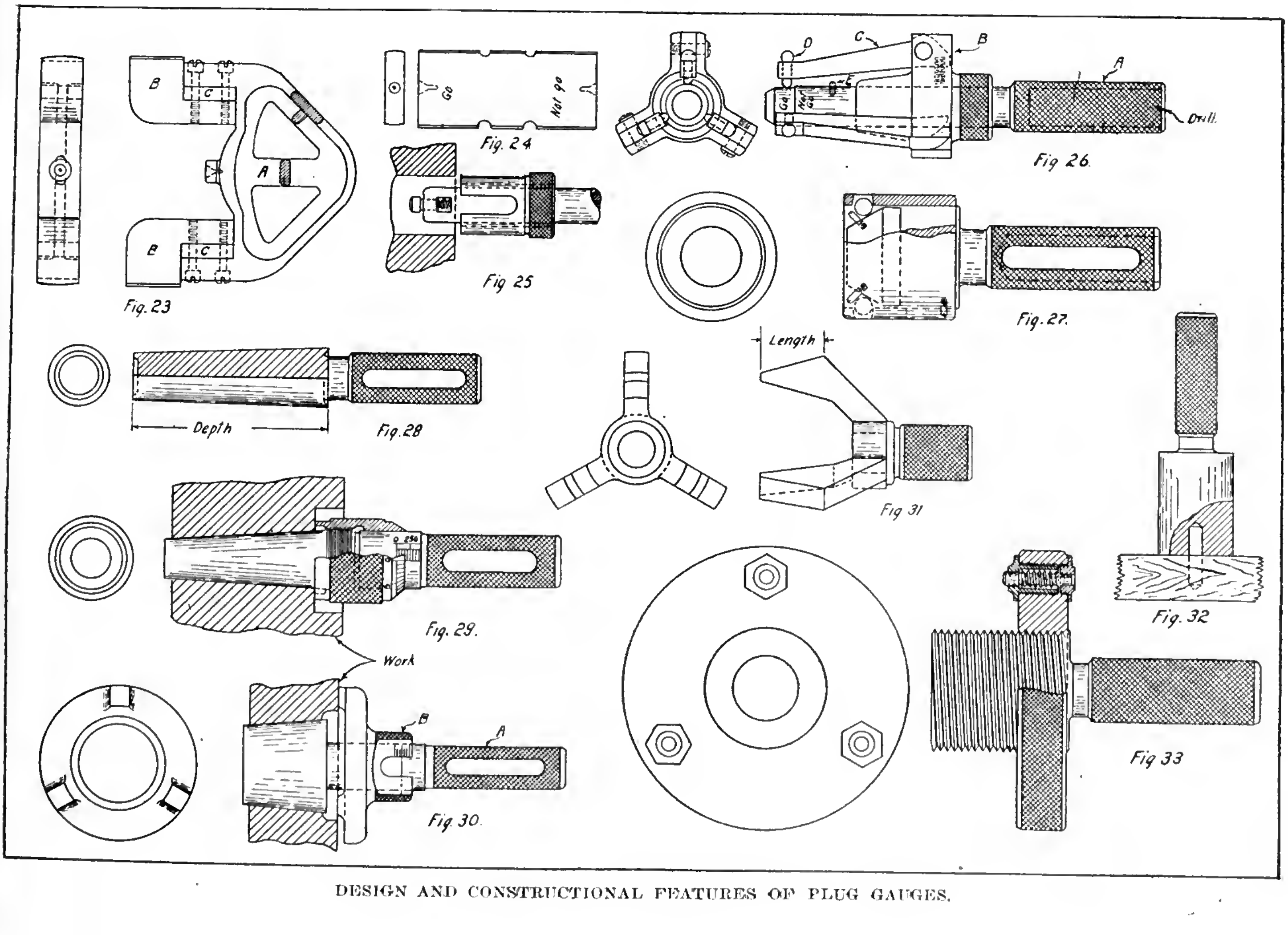
Another form of ball race gauge is shown in Fig. 27. This also works on the principle of a sliding plug. The measuring points in this case are two steel balls. A tubular cage (B) and two studs keep the balls from dropping out of place.

The gauge in Fig. 28 is the type commonly used for gauging taper holes; the large end shows the depth to which the gauge should enter.

Accurate Taper Gauge.

Where a very high degree of accuracy is required, a gauge similar in construction to that illustrated in Fig. 29 will answer the purpose. It operates on the micrometer principle. The graduations read to a thousandth part of an inch.

Fig. 30 is also an indicating gauge, but not so well adapted for accurate work. To the plug A is fitted a movable ring (B). A flat is milled on B. On this are marked the graduations. A zero line is inscribed on the circumference of the straight portion of the plug. Attention is called to the three bosses on the ring (B). These must be ground at right angles to the axis of the hole.



DESIGN AND CONSTRUCTIONAL FEATURES OF PLUG GAUGES.

The type of gauge shown in Fig. 31 is for measuring the relation of a taper to a shoulder or bottom of a blind hole. When the ends and circumferences of the three fingers are all in contact with the work, there will be no perceptible shake of the gauge in the hole.

Protecting Plug Gauges.

Referring to the illustration, Fig. 32, it will be seen that a hole is drilled in the end of a plug gauge. This is done to allow the gauge to be placed over a pin inserted in a shelf used for holding the plug gauges. It can readily be seen that gauges so arranged are kept from shifting about, and are protected from injury.

Thread Testing Gauge.

In Fig. 33 is shown a flush pin gauge used in connection with a thread plug gauge. It is used to determine if a machined face is at right angles to the axis of a threaded hole. The plug is screwed into the hole for about two-thirds of its length. The ring containing three flush pin gauges is then brought forward against the machined face and the relative position of the flush pins noted.

Keyway Gauge.

Because of the large amount of work done on the broaching machine, gauges of various shapes are needed to check results. Some, if made in the usual manner—that is, made solid, would be too costly. A built-up gauge shown in Fig. 34 is used for gauging three keyways spaced 120 degrees apart.

Duplex Gauge.

Fig. 35 illustrates a type of checking gauge for gauging the diameter of two holes. It also serves to gauge their centre distance or relation to each other.

Multiple Gauge.

Fig. 36 shows how two bores and three faces are measured by means of a single gauge. The flanged bushing (A) is hardened and is ground on the diameter and the inner face of the flange. It measures the centre hole in the work. The steel blocks, B and C gauge the depth of the two faces from the flange. The part D gauges the large bore. All parts are fitted to the frame E after hardening, and ground on centres provided for the purpose.

Inspection Gauge.

Fig. 37 is a gauge used in the inspection room for gauging the diameter of a wrist pin hole in a piston. A straight edge is provided for determining if the hole is at right angles to the diameter of the piston.

Profile Gauge.

Fig. 38 shows a form of checking gauge used for gauging the profile of the work with its relation to the hole. The profile templet A is made of Ketos non-warping tool steel. A slot or kerf is milled in plug B to receive this templet. It is secured by means of three screws shown.

The gauge illustrated in Fig. 39 is not a plug gauge, but is well adapted for gauging the ring grooves in pistons and work of like character. The dimension W represents the width and (d) the depth of the groove.

Combination Gauge.

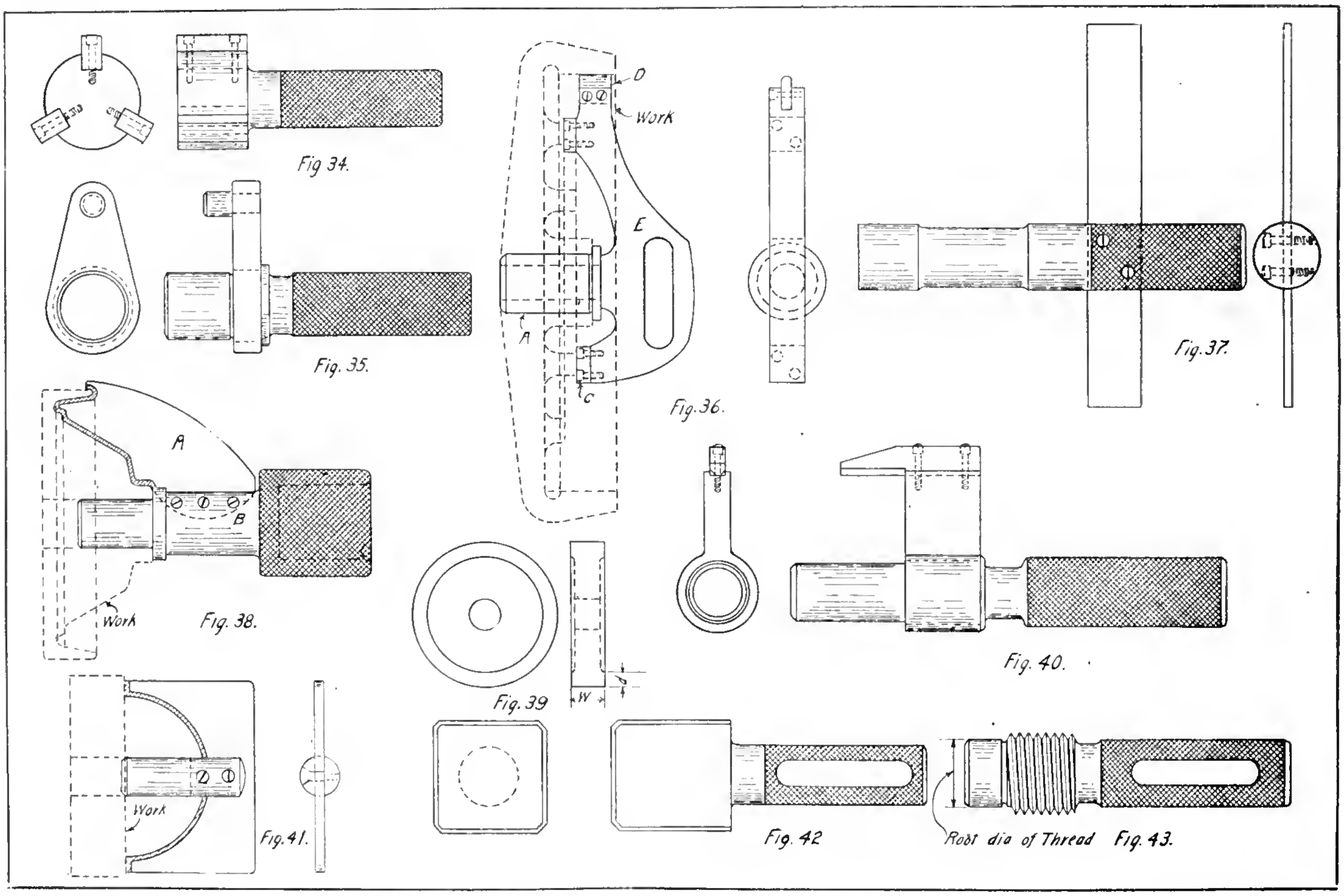
Fig. 40 is a combination of plug and snap gauge. It is used to advantage where a hole and outside diameter are to be gauged. This form of gauge should only be used when the limits on the outside diameter are not very close.

Fig. 41 is another plug profile gauge of almost similar construction as that described in Fig. 38.

Fig. 42 is a plug gauge for square holes.

Reference Gauge.

Fig. 43 is a standard reference gauge, and is only used in the tool-room for comparing with the shop gauges. They should not be hardened.



DESIGN AND CONSTRUCTIONAL FEATURES OF PLUG GAUGES.

Grinding Wheels: Their Material and Manufacture

The adoption of grinding as a commercial operation in machine shops has been very marked in connection with shell making. While most users are familiar with the suitabiliy of different abrasives for certain classes of work, the principal features regarding the manufacture of grinding wheels have always remained more or less unknown.

GRINDING as a means of removing metal has been brought to a state of such perfection and applied to such a broad field of manufacture that grinding machines excite no more comment than engine lathes or other manufacturing tools. The great advances made in the production of high-speed steel have monopolized the attention of manufacturers to so great an extent that the degree of perfection attained by the makers of grinding wheels has not been proportionately recognized.

The subject of grinding has received considerable attention from Mr. John Davey, of Glasgow, who recently read a paper before the Keighley Association of Engineers. The subject of materials and processes involved in the successful production of grinding wheels is treated by him in a most interesting way, and the information conveyed is certain to be appreciated by many users of abrasive products.

Abrasives: Natural and Artificial.

The principal natural abrasives are emery and corundum. The artificial abrasives are becoming increasingly numerous, and include carbolite, carborundum, crystolon, and alundum. These substances are all products of the electric furnace.

Emery.

Emery is simply corundum with a number of impurities present, which frequently accompany it in its natural state. Several years ago practically all grinding wheels were made from emery obtained from the vicinity of Smyrna and Chester, Mass., U.S.A. The value of emery as an abrasive depends upon the proportion of crystalline alumina oxide which it contains. This is the only element in emery which is hard enough to have any appreciable cutting action on metals.

Corundum.

Pure corundum was adopted in preference to emery. Being harder, the grains held their sharp points longer, while the absence of impurities, which caused increased friction without removing any metal, reduced the heat generated, thus allowing output to be increased.

Corundum has been obtained in India, and also in the States of Georgia and North Carolina, but nearly always in small deposits of varying quality. It would contain crystalline alumina to about 77 per cent. Due to its superiority over emery, it was eagerly sought after by the makers of grinding wheels. The supply from the sources mentioned was limited and uncertain, so that it did not come into general use until the discovery in 1896 of the now well-known Canadian mines. Not only do their deposits contain an unlimited supply of corundum, but the quality is far superior to any previously mined. It is found to contain 90 per cent. crystalline alumina and will often analyse much higher. Sharpness combined with just the right temper, has made Canadian corundum an ideal abrasive for most kinds of grinding. The Canadian corundum is mined in Eastern Ontario, the known deposits covering an area of about 32 miles long and 5 miles wide.

Carborundum.

Carbolite, carborundum and crystolon are different formations of the same substance; i.e., carbide of silicon.

Carborundum is distinct from anything found in nature. It is the product of the electric furnace, and being under human control, its freedom from impurities is assured. Carborundum is the trade name for carbide of silicon. It is the crystalline formation of the elements of carbon and silicon, brought about by subjecting a mixture of coke and sand to the inconceivable heat of 7,000° Fahr. The mixture is placed in the electric furnace, a fire brick structure 50 ft. long by 8 ft. wide, through which is built a core or resistance path. Leading to the core are the carbon rods attached to a set of power electric cables. To the mixture of sand and coke is added a quantity of sawdust which makes the mixture porous, so as to allow for the free escapement of gases which are found during the operation. When the furnace has been filled the electric current is turned on and travels along the core, generating a heat that really is beyond human comprehension. It is a temperature at which steel, marble, granite or the highest refractory substances would not only melt, but would vaporize. In this tremendous heat the element of carbon and the element of silicon fly together and form crystal masses of the most beautiful hues. It takes 36 hours for the crystal to form. At the end of 36 hours the outer crusts of the mixture are broken into, the crystal masses removed and taken to the crushing department. The grains are, then carefully washed free from dirt, dried and separated into the different sizes of grains.

Carborundum is particularly suited for foundry work and grinding cast iron in the cylindrical and surface grinding machines.

Alundum.

Alundum is oxide of alumina in crystalline formation. It is made by fusing the mineral bauxite to an intense heat in the electric furnace by the arc process. Chemically, bauxite is the purest form of aluminum oxide found in nature. The best bauxite mines are those found in the southern part of U.S.A., and only the best from these mines are used in the manufacture of alundum. Bauxite was considered infusible until the invention of the alundum electric furnace.

The furnaces used for the manufacture of alundum are different from the electric furnace used for the making of carborundum. They are conical-shaped pots, which stand on a car, and are heated by two vertical electrodes, which are gradually raised as the molten bauxite fills the furnace. The bauxite, as it is prepared for the furnace, is in the form of coarse gravel, that is, the bauxite as it comes from the mine is in a wet, clayey state. It is dried by means of a rotary calciner. The cylinder of this machine is 60 ft. in length, and is heated by two gas producers, the material being fed in at the farthest from the fire. Platforms are erected upon which the dried bauxite is placed, and it is fed into the electric furnace through the top.

Alundum is very suitable for use in the cylindrical and surface grinding machines for grinding hardened and soft steel, brass, bronze, etc.; in fact, it covers the same field as corundum.

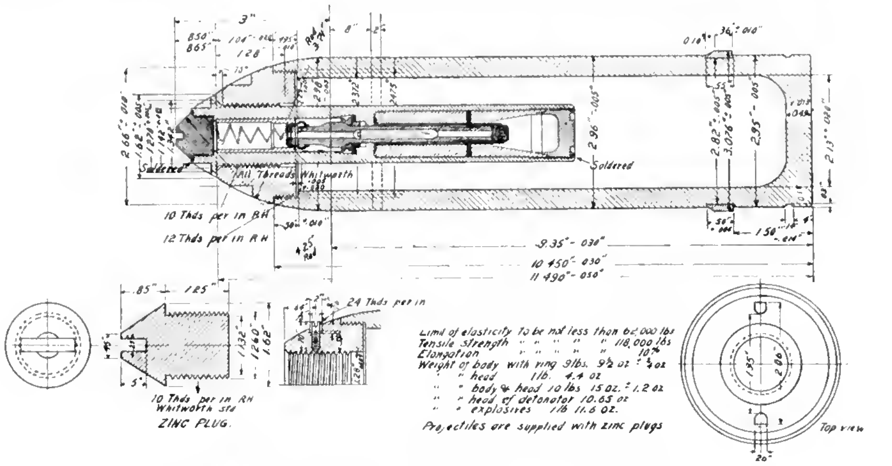
Three distinct processes are now widely employed for binding together abrasive grains to make grinding wheels. These are the vitrified, silicate and elastic, and each produces wheels specially suited for certain kinds of grinding.

Vitrified Process.

More grinding wheels are made by the vitrified process than any other. It consists in mixing suitable clays and fluxes in certain proportions with the grains of abrasive. This is generally done by the wet process, when a large amount of water is added and the mixture stirred in mixing kettles, until it is quite fluid. In preparing the mixture before the water is added, great care is taken to get the correct proportion of abrasive and the different clays, and in the case of combination wheels, where different size grains are used, the same precaution is used, so that wheels can be duplicated at any time. If an order is passed into the works for a wheel of a certain grit and grade it is made to the standard

formula. Some years ago a great deal of trouble was caused by the wheels varying, but by the use of improved methods and care in weighing out the correct proportions of abrasives and clays this has been reduced to a minimum.

After the mixing, the mixture is drawn off into moulds and dried in drying rooms until it is hard enough to be handled. The wheels are moulded larger than the size wanted, and are shaved off on a machine resembling a potter's wheel. The hole is also put into the wheel on the machine while the wheel is in its semi-finished state. The next process is placing the wheel in the kiln. The kilns vary in size, some containing a chamber 18 ft. in diameter and 8 ft. high. The wheels are placed on fire-brick tiles, then surrounded by fire-clay rings, until the stand is complete. The kiln will hold several hundred wheels. The period of burning varies according to the size of kiln. In the larger kilns it takes nearly three weeks from the time the kiln is charged until it is drawn. During the baking or burning process the temperature is gradually raised until it is hot enough to vitrify or partially melt the clay, about 3,000° Fahr. The utmost skill and care are required to successfully burn a kiln, and every possible device is used to bring the operation under perfect control. If the temperature is allowed to change too quickly the wheels will be cracked. If they receive too much heat they will be harder than intended, and if not enough they will come out too soft. Wheels made by the vitrified process are those mostly in use on cylindrical and surface grinding machines, as they are free cutting.

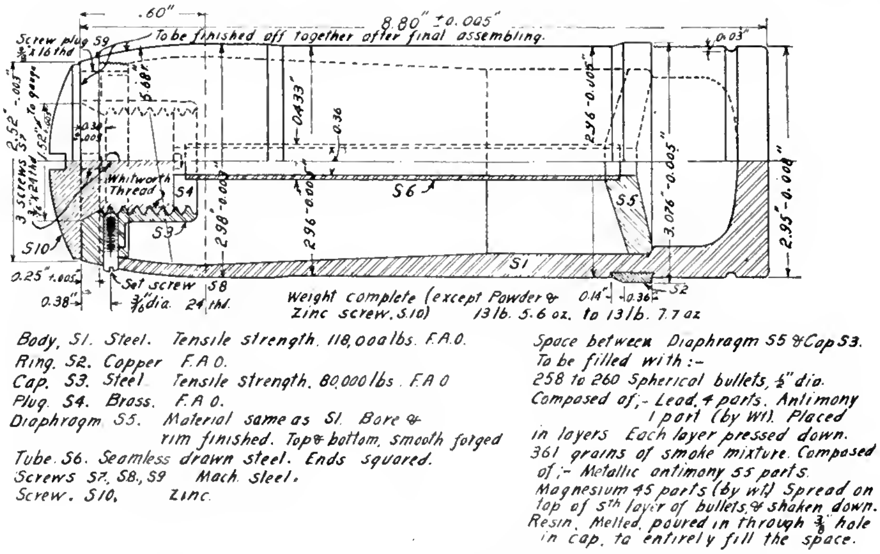


RUSSIAN 13½-PDR. HIGH EXPLOSIVE SHELL.

Silicate Process.

Silicate of soda or water glass is the principal ingredient in the bond of these wheels. After it has been thoroughly incorporated with the abrasive grains in special mixing machines, the whole mass has a thick adhesive quality. In this condition it is rammed into moulds. This part of the work requires considerable skill, and the uniformity and balance of the wheels depend largely upon the skill of the moulder. The wheels are then dried and afterwards baked in special ovens, from which all fire gases are carefully excluded. This causes a chemical reaction, which hardens or sets the bond, and after sufficient cooling, the wheels are ready to go to the finishing room. Some shapes of silicate wheels are moulded under hydraulic pressure, as, for instance, dish wheels, and all very hard silicate wheels are so moulded.

Water glass is the principal ingredient in the bond of silicate wheels, but other substances have to be added. Wheels made by this process are used for cutter sharpening, tool grinding, such as lathe and planer tools, etc. They can be furnished in a few days, and can be made up to 60 inches diameter or more, which is not possible in the vitrified process.



RUSSIAN 15-PDR. SHRAPNEL SHELL WITHOUT FUSE NOSE.

Elastic Wheels.

Shellac is the principal ingredient of the bond of elastic wheels. After the mixture has been suitably prepared, its consistency is such that if thin wheels are wanted it may be rolled into shallow moulds. Thicker wheels are moulded under hydraulic pressure or rammed into moulds the same as silicate wheels. They are then baked at a low temperature to set the shellac. By the elastic process very thin wheels may be made and used with safety. Wheels as thin as 1/32 inch are procurable, and are very useful for cutting of small bars of high-speed steel. Wheels made by this process can be supplied in a few days. All wheels require to be more or less finished after the baking or burning process. This work is done in special lathes, using a circular steel cutter and other types of wheel dressers. After finishing, the wheel is mounted on balancing ways. If not in balance, it is made so. It is then revolved at a speed 60 per cent. in excess of its working speed, producing a stress more than twice as great as that developed in use.

The wheels are tested for hardness by using a sharp-pointed instrument and comparing them with master discs that are kept as standards.

H. L. Gantt says scientific management will reduce costs, or, what is its equivalent, the time and effort necessary to do a certain amount of work, but it will not solve the labor problem; it will not in the long run tend to raise wages or increase profits. Scientific management is suffering more from the fact that too great claims are being made for it than from anything else. Far more fundamental reforms are necessary.

When opening up any steam line, take the following precautions:—(1)—Open all available drips. (2)—Warm the line by opening the stop valve sufficiently to warm slowly. (3)—Never allow an inexperienced man to turn steam into a cold line. (4)—Never open the main valve until certain that the line is thoroughly heated.

Principles of Laying—Off Cylindrical Intersections---II.

By J. W. Ross

The more or less special nature of the work involved in the making of sheet metal piping has caused many manufacturers to avoid this class of work, with the result that when a job has to be handled, there is frequently considerable unnecessary loss incurred through errors in laying off material. The examples treated by the writer of this article should form a valuable reference to many manufacturers on ordinary as well as special occasions.

HEAVY PLATE TEE.

FIG. 1 shows in perspective a Tee which it is proposed to develop in heavy plate. The front and side elevations are shown in Figs. 18 and 19 respectively. The measurements will be given in feet, the student reducing the dimensions to any desirable scale.

Construction.

Measure off C D Fig. 18 equal to 91 inches. Draw the lines A C and B D at right angles to C D, and equal in length to the outside dia. of the pipe which is 37 inches. Draw the line A B parallel and equal in length to C D. C A B D shows the side elevation of the horizontal cylinder.

Bisect A B at L, and raise the perpendicular J L 10. Measure off L 10^1 equal to 22 inches. Through and with 10^1 as centre, draw the line 7^1, 10^1, 1^1, at right angles to the line L 10^1, and equal in length to the neutral diameter of the pipe which is 36½ inches. Project the points 7^1 and 1^1 down at right angles to A B, locating the points 7^2 and 1^2 respectively. Connect these points which will show the neutral outline of the vertical pipe. Build around the neutral lines 7^1, 7^2, 1^1, 1^2, the cross section of the plate thickness. With O as centre describe the neutral plan view of the vertical cylinder. Divide this circle into a suitable number of equal spaces. This number to be at least divisible by four as was previously explained to show lines on each quarter of the circle. The greater the number of spaces the more accurate the developments. To save confusion of the lines in such a small drawing the number 12 has been chosen. Project all these points, parallel to 10, J, and down through A B, indefinitely. Now construct the end elevation view. Draw the centre line 7, E, Fig. 19 parallel to the centre line 10, J, Fig. 18. Project the line A B, Fig. 18 over to its intersection of the centre line 7 E, Fig. 19, thus locating the point 7^2. Locate the point E by projecting the line C D Fig. 18 over to the centre line 7E, Fig. 19. With centre K and radius K E describe the circle representing the end view of the outside circumference of the horizontal cylinder A B D C. Project the line 7^1 10^1 1^1, Fig. 18 over to 4^1, 1^1, 10^1, Fig. 19. With centre O^1 and radius equal to half the neutral diameter of the vertical pipe draw the circle 1, 4, 7, 10. Divide into 12 equal parts. This plan is shown as a quarter turn to that of the plan view in Fig 18. Therefore number accordingly. From all these located points drop projectors—parallel to 7 E—to the intersection of the horizontal end view. Number all these intersections in relation to the plan view. With K as centre, draw in the neutral circle line and thickness of the plate for the horizontal cylinder. Also build up the plate thickness around the neutral lines 4^1 4^2 and 10^1, 10^2. Horizontally project the points 1^2, 2^2, 3^2, 4^2, etc., Fig. 19, to their intersections of the similarly numbered vertical projection lines in Fig. 18. In this manner locating the mitre points by the points 1^2, 2^2, 3^2, 4^2, 5^2, 6^2, etc., Fig. 18. Connect these points by an even curve thus defining the mitre line. With ¾ inch radius draw in the neutral line as at the points 1^2 and 7^2, Fig. 18. With ½ inch and 1 inch radii draw the cross sectional plate thickness. Draw in the laps. Locate the laps as F and G, Fig. 18. Similarly draw in the flange, rivet, and lap allowances as shown by H in Fig. 19. Now proceed to develop the vertical pipe.

The neutral diameter equals 36½ inches. The stretchout equals 36½ × 3.14 which is 114.61 inches or nearly 114⅝ inches. Measure off 1^1, 7^1, 1^1 Fig. 20 equal to 114⅝ inches. Divide into 12 equal spaces. Project these points downwards. Number with the object in view of having the vertical rivet seam on the lines 1^1, 1^2—1^1, 1^2. Now set the dividers to the distance 1^1, 1^2, and 7^1, 7^2, Fig. 19. Transfer this over to this numbered element lines in Fig. 20. Proceed in a similar manner by transferring the distances 2^1, 2^2, 3^1, 3^2, 4^1, 4^2, Fig. 19 to their respective locations in Fig. 20. In transfering these measurements ignore the flanges at F and G, Fig. 18, and H, Fig. 19. The reason for this is as follows:—4^1, 4^2, Fig. 19, is drawn without the flanges, the neutral line striking the circle as shown at 4^2. On the line 10^1 10^2 the flange is shown, and the neutral line is drawn in its correct relation to the plate thickness. To transfer 10^1 10^2 take the measurement as was done for 4^1 4^2. Draw an even curve through these located points on Fig. 20. This is shown drawn with short dash lines. This line would be the flange line in light plate. In heavy plate this line will change according to the thickness of the plate used. The plate thickness in the drawings Fig. 18 and 19 is somewhat exaggerated for explanatory purposes. Again to show it more clearly, the section of plate on the line 1^1, 2^2, Fig. 18, is enlarged in Fig. 21. In Fig. 21 the inside

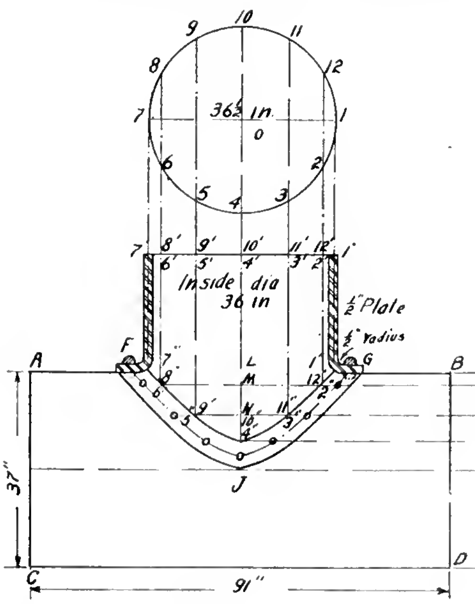


FIG. 18.

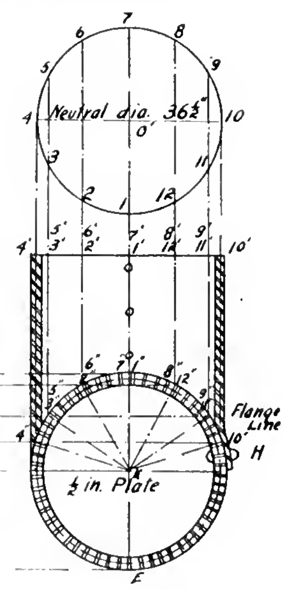


FIG. 19.

*Note: The reference letters and numerals in the text, i.e., G^2, 7^2, etc., correspond with those of the illustrations indicated as G", 7", etc.

radius of the bend is ½, therefore the neutral radius will be ¾ inches. R locates the centre for this radius and P and S the extremities of the quadrant. Bisect this quadrant at Q, thus locating the centre of the flange. Measure carefully along the neutral line the straight as well as the curve from 1^1 to Q. Take this distance and transfer it over to the line 1^1 1^2 Fig. 20, to locate the point Q, for the flange line of the templet. Again measure from Q to the centre of the rivet, and also from the rivet centre to the edge of the lap Fig. 21 transfer this also to the rivet line 1^1 1^2 Fig. 20 to locate the rivet line on the flange and the lap edge. These dimensions may be calculated. The neutral radius R, P, multiplied by 1.57 will give exactly the length of the neutral quadrant P Q S. R P equals ¾ inch, and ¾ × 1.57, equals slightly over 1⅛ inches, which is the length of the neutral quadrant P Q S. Now 1^1 P equals 22 inches minus the ½ inch for radius and the ½ inch for plate thickness, which equals 21 inches. P Q equals ½ of P Q S — 9-16 inches. Therefore 1^1 P, plus P Q, equals 21 9-16 inches. This dimension being equal to 1^1 Q in Fig. 20. Also Q S which equals 9-16, plus 1¼ inches to the rivet centre, plus 1¼ inches to the edge of the lap equals 3 1-16 inches total.

Q G, Fig. 21 therefore equals 3 1-16 inches. Measure off 7^1 Q G equal to 1^1 Q G Fig. 20. Refer back to Fig. 19. Measure along the neutral line the distance from 10^1 to the flange line Q and from Q to the rivet centre, and from the rivet centre to the lap edge, transfer these measurements to Fig. 20 on the lines 4^1 Q H and 10^1 Q H. With the five points Q located, draw in the flange in relation to the mitre line also draw in the rivet line and lap edge. Space off the rivet centres into a suitable number of equal spaces. One of the corners is scarfed, that is, thinned down, to permit of a close fitting joint at this point when the plate is rolled and fitted into position. As was stated before it is not the usual practice to put the holes in this templet. These holes being marked off when fitted on the rolled up horizontal cylinder.

The opening and the rivet holes will now be marked off in the cylinder as shown in Fig. 22. Calculate the stretchout of the horizontal cylinder of which the neutral diameter equals 36½. The stretchout equals 36½ × 3.14 which is nearly 114⅝ inches. Measure off D B D Fig. 22 equal to 114 ⅝ inches. Bisect to locate B, erect the perpendiculars B A, D C, and D C equal in length to that of D C Fig. 18. Draw the line C A C parallel to D B D. Draw radial lines from the points 1^2, 2^2, 3^2, 4^2, 12^2, etc., Fig. 19, to the centre K. Note where these radial lines intersect the neutral line of the cylinder of which K is centre. Transfer all these distances from these points measured along the neutral line as 1^2 to 2^2, 2^2 to 3^2, etc., Fig. 19, to the distances 1^2, 2^2, 2^2, 3^2, etc., on the line C A C, Fig. 22. Through these points Fig. 22 draw

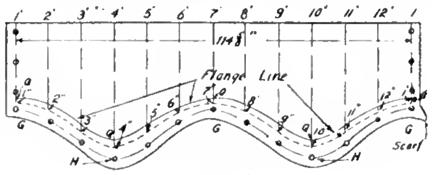


FIG. 20.

lines parallel to the centre line A B. Number these points and lines corresponding to the points from which they were transferred. Bisect C D at J and draw in the horizontal centre line J J. Locate L Fig. 22 at the intersection of J J with 1^2 7^2. Locate M at the intersection 2^2 6^2 and 12^2 8^2. Similarly locate N. Take the distance L to 1^2 on the mitre line Fig. 18, transfer this to L, 1^0 Fig. 22. Again

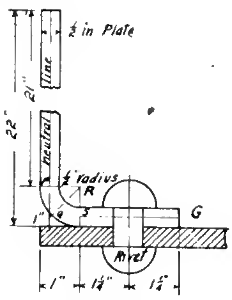


FIG. 21.

take the distance M 12^2 Fig. 18, and transfer over to M, 12^0, Fig. 22. Similarly transfer the remaining distances N, 11^2, N 3^2, L 7^2, etc., from Fig. 18 to their respective positions as N, 11^0, N 3^0, L 7^0, etc., Fig. 22. Connect all these points with a fair curve thus locating the outline of the opening. Take the distance 1^2 to the rivet centre at G Fig. 18 and measure this off to locate the rivet centre on the line 1^2 7^2 by measuring

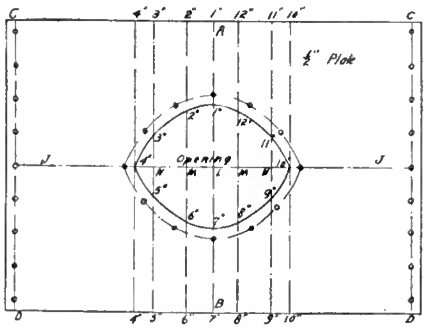


FIG. 22.

from the points 1^0 and 7^0. Similarly locate the other points for the rivet line. Draw in this line and space off the rivets equally. Space off the rivets equally on the seams C D, so that when the plate is rolled up all the holes will come fair. This completes the templet. The method in this problem of drawing the plate thickness is applicable to the preceding as well as the following problems when dealing with heavy plate.

PACKING HYDRAULIC JACKS.

HYDRAULIC jacks sometimes fail to develop full capacity, or settle slowly when left standing under a load, without apparent reason. Such failures, says the engineering department of the Travellers' Insurance Co., are commonly due to defective packing. These defects are first evidenced by the failure of the jack to raise or hold the load, and, when this is noted, the jack should be examined to find out where the packing failed to hold. The leakage at the defective point is readily detected. A prominent manufacturer of hydraulic jacks makes these recommendations with regard to the valves and their seats:—

If the packing is in good order and the ram does not rise in pumping the suction valves are not working properly. If the lever rises when the hand is removed, the pressure valve is not working properly. If the valves or their seats become worn or scratched, grind them to a fit with oil and a little flour of emery. Be careful not to grind them too much, and be sure to wash the valves and their seats perfectly free from emery before putting the jack into service again. If the valves are deeply scored or have become too much worn, replace them with new ones, and grind new ones lightly to their seats, as described.

Short Circuits usually come on slowly, and discriminating protective gear and quick-acting circuit breakers should be a sufficient safeguard to the station without the use of reactances. While it is quite true that discriminating protective gear may do much to increase the safety factor of the system, the fact remains that "dead" short-circuits will sometimes occur, and that in such events no switch or relay is sufficiently quick-acting to open the circuit breaker before the rush of current has occurred. Furthermore, no discriminating gear can protect the generator in the event of a misphase, and it is well known that the strain on the generator may be greater in the event of a misphase than if the generator short-circuited directly across its terminals.

If a man works for you, Mr. Employer, have confidence in him. If he be not deserving of your confidence discharge him at once. Suspicion and aloofness never helped any fellow in any situation.

EDITORIAL CORRESPONDENCE

Embracing the Further Discussion of Previously Published Articles, Inquiries for General Information, Observations and Suggestions. Your Co-operation is Invited

MAKING SPRINKLER TAPS.

By F. M.

THE growing use of water sprinklers for fire protection has brought out a special style of short tap for threading the connection shown in Fig. 1. A sketch of the finished tap is shown in Fig. 2.

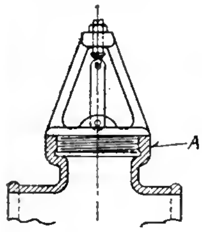


FIG. 1.

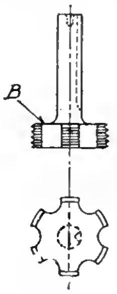


FIG. 2.

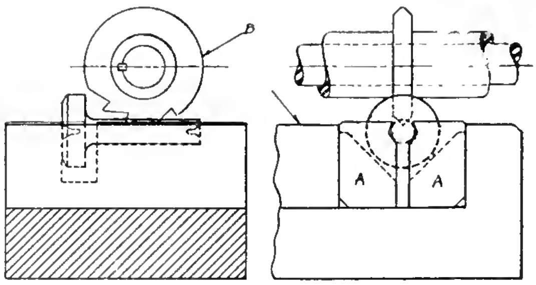


FIG. 6.

MAKING SPRINKLER TAPS.

To facilitate the operation of rough turning on these taps, when made in large quantities, the stock is prepared so that all the heavy turning is performed in pairs before finishing.

The first manufacturing operation is the cutting to length, which is done in a rotary saw, as shown in Fig. 3. Six bars are placed in the vee clamps and are cut off to a length, equal to twice that of the taps plus the width necessary for parting, after they have been rough turned.

After cutting to length, the pieces are centered on each end in the centreing machine shown in Fig. 4. The work is held in a central position by means of the vee blocks C and fed to the combination centre drill A, by means of the swinging lever attached to the tail stock spindle. The piece B, also shown in Fig. 5, has a knurled cup centre inserted, which takes the place of a dog to prevent the work from turning while being centred.

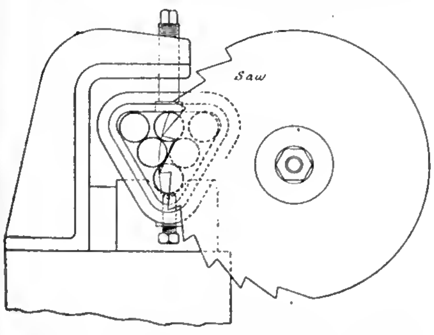


FIG. 3. MAKING SPRINKLER TAPS.

The pieces are next placed in a lathe and rough turned alternately on each end until within 1-32 in. of the finished sizes. The rough turning having been completed, the pieces are parted, the burr ground off and the ends centred. They are then turned in successive operations of, face shoulder (leaving large fillet for strength), turn shank, turn for thread, chamfer, mill the groove, cut the thread and mill the flutes. The milling of the groove in the shank is performed in the jig shown in Fig. 6. The two steel vee blocks A A are held in the vise, thus gripping the shank of the tap and leaving room at the top for the cutter B to mill the groove.

When threading the taps, a shoe is placed in the milled groove in the shank to prevent slipping. After threading, the flutes are milled to form the tap. The lands are then backed off and the tap hardened and ground. The hardening was done by heating the taps in a lead bath to the proper temperature and quenching them in water or oil. After tempering the shank was ground and also the flutes with a formed wheel.

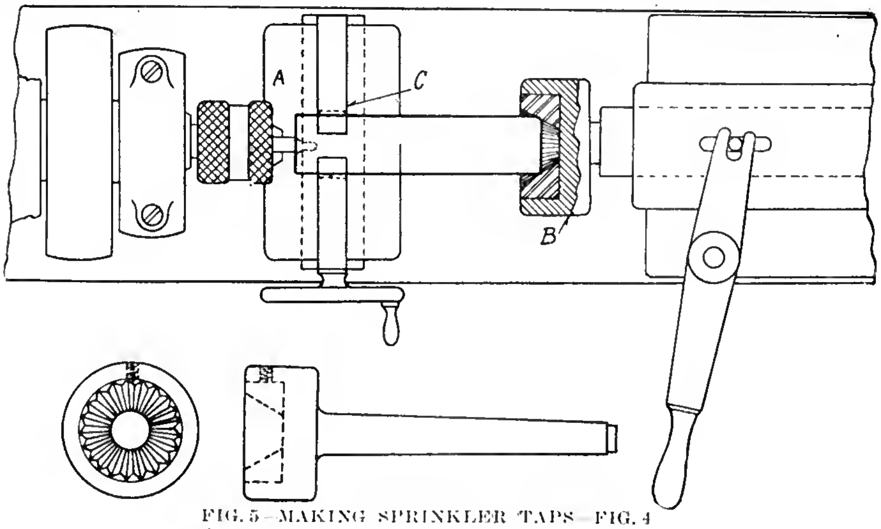


FIG. 5—MAKING SPRINKLER TAPS—FIG. 4

REPAIR TO A SPUR GEAR.

By J. McCormack.

SOME time ago I observed the following repair made upon the broken teeth of a spur gear. Holes were drilled where the teeth had been, care being taken to retain the proper position. The holes were tapped of a size to suit the thickness of the teeth in the gear. The rod stock was threaded with an adjustable die and made sufficiently over-size to be a tight fit in the tapped hole. The pins were placed a little more than their own diameter apart and directly in line with the corresponding pin in the row ahead. Those in the pinion were placed to correspond with those in the gear to prevent uneven contact. This repair, although fairly serviceable, was only temporary, new gears being secured within a few days.

COST KEEPING IN SMALL WORKS.

By M. B. Saunders.

THE one great trouble that the manager of the small jobbing shop has is to be able to keep a really accurate system of costs, without having a large staff to handle it. The following is an outline of a cost system used in a small shop, doing a very great variety of repairs, as well as a small amount of manufacturing.

Numbered order sheets A, are kept in the office, and when a job comes in, the name and details are entered in duplicate by means of a piece of carbon paper on the right half of the form A: the part marked A1 being torn off and given to the foreman. The large part A, being then put in a loose leaf binder and kept

in the office as a record of the job including all details as supplied to the foreman.

TIME

Hrs. Rate

FACTORY CHARGES

MATERIAL

STANDING CHARGES

TOTAL

A

Northern Ontario Engineering Works, Ltd.

Order No 2621 Date May 1st/14

Name John Smith

Ref. order left by Master Mechanic.

Make new piston rod for 8"x12" hoist. (as sample supplied)

Date Finished

All Material used on this Job must be Entered on this Sheet.

A1

COST KEEPING IN SMALL WORKS—ORDER SHEETS.

Now to follow this order right through to completion we will suppose it calls for a new piston rod for an 8 in. x 12 in. hoist. The foreman takes the job to a man, explaining what is necessary, and gives him a job card, Fig. B, and punches the time he starts, also if material is required; when material is required the foreman enters the particulars upon the back of the card.

Later during the day the man reports that the job is completed. The foreman having inspected it, punches the card at the stopping time and drops it in the box provided at the office.

In order to check up the number of productive hours during the day, the workman's time sheet, Fig. C, simply call for him to fill in his name and date, time he starts and leaves his work.

DATE Dec. 10th.

NORTHERN ONTARIO ENGINEERING WORKS, LIMITED

ENGINEERS AND MILLWRIGHTS

WORKMAN'S NAME F. Lobb.

These details will be filled in by Cost Clerk.

F. O. No	HRS
2275	3
2284	2½
2283	1
2278	2½

TOTAL 9 HRS.

MORNING

8 TO 12 = 4 HRS

AFTERNOON

1 TO 6 = 5 HRS.

OVERTIME (IF ANY)

TO = HRS.

TOTAL 9 HRS.

COST KEEPING IN SMALL WORKS—WORKMEN'S TIME SHEET C.

The next morning the cost clerk takes all the time sheets and job cards to his desk. First he enters the number of hours and material up to the various factory order numbers and then takes each man's time sheet and marks upon it the f.o. numbers: the time on these should correspond to the hours marked opposite which the man expects to be paid for.

When this system was first installed by the writer, errors were found, showing where a man had 9 hours on his time sheet and only 8 hours on his job card,

JOB CARD

Northern Ontario Engineering Works, Limited

Date Dec. 10

Workman's Name Mc Mahon

F. O. No. 2302

Total Time to Date

Commenced A. M. / P. M.

Finished A. M. / P. M.

Total No. Hrs Recorded on this Card 7½

Entered by AM.

NOTICE

You must not start or leave this job on any account without getting this Card punched by the foreman. This Card to be passed by the foreman and returned to the office at the end of the shift, and a new Card obtained when the job is continued.

The foreman will enter any material used upon the back of this Card.

There is not Material to be charged on this Job.

This Job is not completed.

OK FOREMAN

7.00 .15 .30 .45 .00 .15 .30 .45 00 .15 .30 .45 10.00 .15 .30 .45 11.00 .15 .30 .45 12.00 1.00 .15 .30 .45 2.00 .15 .30 .45 3.00 .15 .30 .45 4.00 .15 .45 5.00 .15 .30 .45 6.00 .15 .30 .45 7.00

COST KEEPING IN SMALL WORKS—JOB CARD B.

thus giving an accurate record and also a check upon the time wasted between the finishing of one job and the starting of another. Also when a man starts at 7 and his job card shows him starting a job at 7.30, it indicates delays that become costly to the management.

Any number of job cards can be used during the day—one card for each job—and if a job is stopped before finishing and then gone on with the record can be kept on the same card, thus 7 to 11 and 3.30 to 5.15.

When the cost clerk receives the slip A, back from the foreman he knows the job is completed, can transfer his order A to his completed file and invoice the customer in the usual way.

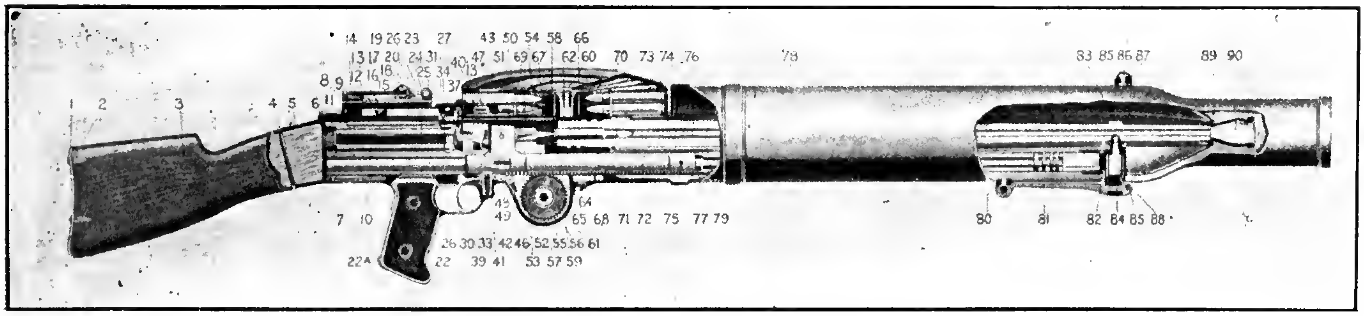
This system at first sight may seem complex and hard to operate but the writer has found that after a few days everything works smoothly.

CONTEMPORARY WAR ARTICLES

Embracing Information and Data Drawn from a Variety of Sources Relative to and Arising from the Prosecution of this Many-Sided European War

THE "LEWIS" AUTOMATIC MACHINE GUN.

THE machine guns which the Ontario Government will supply to our overseas forces at a cost of $200,000, might rather be termed rifles. The official name of the weapon is "The Lewis Automatic Machine Gun." It weighs only 25 pounds without its tripod support, which is four and a half pounds in weight. Thus the whole gun may be carried about by one man, and operated by one man, without difficulty. A powerful man may even use the weapon from the shoulder, as though it were an ordinary rifle. One gun can fire 440 rounds per minute, including the time necessary to change magazines, each of which contains 47 rounds. It is in operation in the French and Belgian trenches at the present time, and is somewhat similar to a Hotchkiss automatic rifle employed by the French.



THE "LEWIS" AUTOMATIC MACHINE GUN

1—Butt plate. 2—Butt plate screws. 3—Butt. 4—Butt tang screw. 5—Butt tang. 6—Feed cover latch. 7—Butt latch, securing butt to receiver. 8—Back sight bed spring. 9—Back sight bed spring screw. 10—Butt latch spring. 11—Back sight bed. 12—Feed cover latch pin. 13—Feed cover. 14—Back sight leaf. 15—Back sight thumb piece. 16—Back sight slide catch. 17—Back sight fine adj. worm. 18—Back sight fine adj. worm axis pin. 19—Back sight slide catch spring. 20—Back sight slide. 22—Firing hand grip. 23—Back sight axis pin washer. 24—Back sight axis pin. 25—Back sight axis washer fixing pin. 26—Receiver. 27—Magazine pawls spring. 30—Trigger. 31—Feed operating stud. 33—Trigger pin. 34—Feed operating arm. 37—Bolt that closes breech and takes shock of discharge. 39—Guard. 40—Cartridge guide spring. 41—Sear spring. 42—Sear. 43—Magazine pan. 46—Gear stop. 47—Striker fixing pin. 48—Gear stop pin. 49—Gear stop spring. 50—Striker. 51—Cartridge spacer. 52—Gear operated by main spring. 53—Main spring casing. 54—Magazine top plate rivets. 55—Main spring which closes breech and returns parts to firing position. 56—Collet pin. 57—Main spring collet. 58—Magazine center. 59—Main spring rivets. 60—Magazine latch spring. 61—Gear casing. 62—Magazine latch. 64—Gear casing side piece. 65—Gear case hinge pin. 66—Feed operating arm latch. 67—Magazine top plate. 68—Receiver lock pin. 69—Cartridge spacer rivets. 70—Interior cartridge separators. 71—Radiator casing rear, locking piece. 72—Rack, actuated by piston and main spring. 73—Radiator casing rear, platform. 74—Radiator casing rear. 75—Piston connecting pin. 76—Barrel. 77—Gas cylinder. 78—Radiator for cooling barrel. 79—Piston operated by gases of exploding cartridge that ejects empty shell and resets firing pin. 80—Regulator key stud. 81—Gas regulator key. 82—Gas chamber. 83—Gas port. 84—Gas regulator. 85—Clamp ring. 86—Fore sight. 87—Clamp ring positioning screw. 88—Clamp ring screw. 89—Barrel mouth piece. 90—Radiator casing front.

The Lewis gun is designed in such a manner that the only tool necessary to dismantle it completely is an ordinary service cartridge, the point of whose bullet is used to disconnect every portion of the mechanism; and this operation is such a simple matter that the gun can be "knocked down" and any small damaged part replaced, well inside five minutes. The weapon takes the service ammunition, and its range is similar to that of the service rifles. When used on a fixed mount the butt stock may be removed and a "spade handle" substituted.

Constructional Features.

The gun is of very ingenious construction. A detachable magazine loaded with 47 cartridges is attached to a suitable fixing on the barrel near its rear end, the first cartridge being fed from the magazine into the firing chamber by the first forward movement of the firing pin, which is, however, arrested before the striker reaches the cartridge unless the trigger is held back. When the trigger is pressed, the striker, carried forward by the mainspring, explodes the cartridge in position in the firing chamber.

Before the bullet leaves the barrel under the influence of the gas pressure, it uncovers a hole connecting the barrel with a cylinder below and lying parallel with it. A portion of the gas passes into the lower cylinder, driving back the piston, and with it, the rod against the pressure of the mainspring. The movement of the rod recocks the gun, throws out the exploded cartridge case, and during the early stage of its return journey, under the mainspring's influence, transfers a live cartridge from the magazine to the chamber.

If the gunner lets go the tripper the firing ceases, and the gun remains cocked until the trigger is again pressed; if, however, he keeps a continuous pressure on the trigger, the weapon continues to fire until all the cartridges in the magazine are exhausted, the rate of continuous fire being as high as 440 rounds per minute, including the interval occupied by replacing empty magazines with loaded ones.

Dissipating Barrel Heat.

The dissipation of the intense heat developed by the almost continuous combustion of explosive charges in the barrel of the machine gun presents a somewhat difficult problem, and failure to accomplish this efficiently causes the barrel to become red hot and prematurely to explode the incoming cartridge. The barrels of the Lewis and the Hotchkiss guns are both cooled by means of ribs which radiate the heat into the atmosphere, those of the Lewis being placed longitudinally and contained in a steel casing, through which cool air is drawn by the "exhausting" effect of the powder blast in the muzzle end of the casing, in the same way that the air is drawn through the fire-box of a locomotive by the blast of the exhaust steam in the chimney.

Recoil Feature.

The recoil on the Lewis gun is counter-balanced in a very simple and ingenious manner, the gas from the discharge being directed by means of a cone attached to the muzzle of the barrel proper, on to the inner surface of the casing, so that the friction between the gas and the metal casing tends to carry the gun forward with the stream of gas, and so

counter-balances the force of the recoil acting in the opposite direction.

The mainspring of the Hotchkiss gun takes the form of an ordinary coil-spring acting in compression situated in the cylinder underneath the barrel; whilst the same unit in the Lewis is a spring of the type used for the mainspring of a watch, but naturally of a much greater power. This spring is coiled up in a circular case attached to the gun just in front of the trigger, in a position sufficiently far from the barrel to be unaffected by the heat, and, consequently, in no danger of losing its temper from overheating. The Hotchkiss mainspring acts directly on the piston rod, which it surrounds; whilst the Lewis is coupled to its rod by a rack and pinion.

The magazine of the Lewis gun is circular in shape, the forty-seven cartridges with which it is loaded lying radially in two layers with their bullets pointing toward the centre.

MODERN MUNITIONS OF WAR.

AT the Royal Society of Arts recently, Professor Vivian B. Lewes delivered the first of a special course of three lectures on the subject of "Modern Munitions of War." The particular branch dealt with was "Guns and Propellants." The remaining lectures on "Mines, Shells and High Explosives" and "Poison Gases and Incendiary Bombs" were given on July 14 and 21 respectively. Sir Boverton Redwood was in the chair, and in introducing the lecturer said that in view of the diabolical ingenuity with which the enemy is carrying on this policy of frightfulness, it was well that the public should be enlightened upon the subject of munitions.

Professor Lewes said: Looking over all the wars we had been engaged in, it would be found that the cry had always been the same. In the Napoleonic wars our troops were crying out for shot and shell. Later, in the Crimea, fodder and food were required in addition to shot and shell, and in the South African War it was really the compartively small amount of ammunition that was required which prevented us being in terrible trouble then. When the history of the present war comes to be written when we have cooled down somewhat and see things in their true perspective — the most wonderful thing of all will be that our supplies of ammunition have been so remarkably good, and that in this war the ammunition supply had been far superior to what it had been in any other war we had ever waged.

Progress in Guns.

As showing the immense strides that have been made in guns and propellants, the lecturer drew attention to the fact that in the Napoleonic wars the old Victory had a broadside of fifty-two guns, and if the whole of that broadside was fired at once the weight of metal thrown was only 60 per cent. of the weight of one shell thrown by the 15-in. guns of our present super-dreadnoughts.

The next development was to rifle the guns, which gave increased range and greater accuracy. Then it became necessary to lengthen the guns in order to get the best effect of the rotation due to the rifling. This progress continued, and by the time of the bombardment of Alexandria in 1882, the smallest gun was double the size of the biggest gun in the Crimea. The old Inflexible in 1882 had four 80-ton guns, 16-in. calibre, an inch bigger than we have to-day, and by 1886 the size had increased to 110 tons, with a calibre of 16.25-in. using a charge of 960 lb. of powder.

Progress in Explosives.

Since that time an enormous increase had taken place in armaments which was accompanied by a very great change in our explosives. In the Crimea, with the 68-pounders, "rifle large grain" powder was used, but after the rifling of the guns was adopted and the guns were lengthened, it was found that this powder occasioned too great a stress on the breech of the gun, coupled with too low a muzzle velocity. To remedy these defects what was known as "rifle indent powder" was used, but this proved to be too expensive, and the Government found a way out by manufacturing what was termed "pebble" powder, the "pebbles" being gradually increased in size until they reached 1¾ in. cube. The desideratum was slow-burning, with a constantly increasing pressure, and "pebble" powder was not altogether satisfactory.

For many years this was an enormous trouble, until General Rodman, of the United States, suggested large solid cartridges with holes from end to end. The explosion passed through these holes, which gave the larger surface necessary to give the increased pressure of gas. It was a beautiful suggestion, but absolutely impracticable owing to the difficulty of obtaining uniformity in density in the powder, and the liability of the cartridge to crack. The idea, however, was put into practical form in prism powder. In this, the powder was made up into prisms with holes in the centre, and as large a cartridge as was desired could be built up in this way.

Smokeless Powder and Gun Cotton.

The next trouble that arose was the enormous quantity of smoke given off, both by rifle powder and prism powder, and it was quickly realized that a smokeless powder was a necessity. In this connection a long line of interesting researches had been carried out in the earlier years of last century. Brief reference was made to the work of Brockenau and Pellews, two French chemists who laid the foundations for the development of smokeless powder. Following this came the discovery of gun-cotton by Schonbein, the Swiss chemist.

Professor Lewes went on to mention the mysterious explosions in various countries which occurred within the next two years, and the complete abandonment of gun-cotton for a time. Meanwhile, the use of gun-cotton was kept alive by the discovery that a lower form of it could be manufactured by using a weaker solution of nitric acid. Subsequently, General von Lenck, of Austria, discovered the true cause of the earlier failures, viz., that as the gun-cotton consisted of fibres acting as minute tubes, these, in spite of washing, retained a certain small quantity of nitric acid. Hence the explosions when the gun-cotton was packed. This having been settled beyond doubt, the quest for a smokeless powder took everyone back to gun-cotton, rendered safe as we now know it, and the man who had never really got the credit for the discovery of converting gun-cotton into a smokeless powder was Dr. Walter Reid, who discovered a smokeless sporting powder.

At the present time nearly every country was making a descendant of this powder of Reid's as their service explosive. The Austrians, Germans, Russians and French were all using nitro-cotton powders, although we ourselves were using nitro-glycerine powder, for the reason that our service powder had to stand the climate of all parts of the world. At the same time it was so unstable that its use per se was extremely difficult and had to be safeguarded by all sorts of restrictions. The German navy, however, used nitro-glycerine powder on account of its smaller bulk and consequent lesser storage space required.

Nobel found that by mixing collodion with nitro-glycerine a gelatine body was obtained. He called this blasting gelatine, and this was still the finest mining engineering explosive in the world. Furthermore, Nobel had noticed that a mixture of nitro-cotton and nitro-glycerine tamed down the exuberant properties of both, and, together with General Hess, of the Austrian army, obtained a wonderfully fine smokeless powder by mixing it with camphor. Later on, however, Sir Frederick Abel and Professor—now Sir James Dewar found that a more powerful and suitable powder could be obtained by blending true gun-cotton and nitro-glycerine. They were mixed by means of acetone, which was afterwards evaporated off, and the result, to which 5 per cent. of vaseline was put in as a lubricant for the gun, was the smokeless powder known as cordite.

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WAR ORDERS AND STOCK MARKET SPECULATION.

ARISING out of the war, business in many spheres of industrial enterprise has been—to put it mildly—stimulated. Metal working plants are particular beneficiaries, although, as regards the personal equipment feature, many other sections of our manufacturing community are experiencing an almost equivalent boom.

A few month's ago, Sir George E. Foster, Canadian Minister of Trade and Commerce in the course of an eloquent address before Ward Three Conservative Association, Toronto, hazarded the opinion that before peace again reigned "this war would sadden us and make us a more serious people, and would teach us that there is something more to live for than mere business, speculation and pleasure."

We are somewhat at a loss as to the popular classification of his then prediction, in a word, whether it were viewed from the standpoint of its avowed intention—the optimistic, or its opposite—the pessimistic. However it be, recent happenings give clear indication that Sir George was all wrong in attributing either sadness or seriousness as our portion of the grim struggle. Each succeeding month of the war duration appears to have been getting us just that much further away from the dual state referred to, and through the increasing demand for war munitions and supplies, is making us to all intents and purposes oblivious of our real individual place and part in the issues at stake.

Patriotism, Sir George made very clear, means sacrifice and not its commonly experienced substitute—skilfully masked service to our individual profit. If we would judge, however, by the wild speculation which has prevailed for several weeks in prominent industrial stocks, it is quite apparent that the attempt to make personal profit out of real or imaginary war order business is the primary and all-important consideration. All of this is, of course, a sure menace to legitimate business, and of necessity must be reckoned with sooner or later.

Men who have been observers of Wall Street for half a century say that while there have been manipulations in the past, those now being carried on are more open than any ever before perpetrated. What is true of Wall Street is equally true of our Canadian stock exchanges.

Industrially, and as a matter of fact in every department of our national life, we have for quite many months suffered severely from excesses of a similar nature. The convalescing process has been a long and trying one, and such as might at least have been expected to breed caution in the future. Not so, however; the war has provided the opportunity and excuse whereby stocks and shares of our industrial enterprises may be deliberately manipulated so that their price be forced up to figures altogether foreign to their value, and so that an unsuspecting public in its thousands and tens of thousands be fleeced and absolutely ruined. The hardships engendered by the excesses and speculation practised in the few years preceding twenty months ago will be but a mere bagatelle when compared to what may be expected when this war order stock speculation comes, as it certainly will to its logical and disastrous end.

We make complaint that much of the war order business that should have been ours has been placed in the United States, and we are not satisfied because of the apparent lack of further and greater consideration being given us in the matter of orders, in the filling of which we have shown ourselves to be fully competent. More war contracts placed, if simply made an excuse for stock manipulation instead of being considered the legitimate business of our Dominion, will in the nature of things contribute little of blessing to our people but much of curse.

Public opinion was never in our history in more need of being aroused than it is to-day relative to stock market gambling in Canadian "Industrials," and, as on the occasion of the outbreak of the war, those responsible for the conduct of our stock exchanges took drastic measures to meet the then abnormal situation, and did so successfully, it is equally incumbent, if not more so that they now tackle the new situation and get it on a sane basis before it gets altogether out of hand and culminates in a business dislocation and demoralization from which it may take well on to a decade to bring back again to normal.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey Forge, Pittsburgh	$13 20	$13 45
Lake Superior, charcoal, Chicago	.....	15 75
Ferro Nickel pig iron (Soo)	.....	25 00

	Montreal.	Toronto.
Middlesboro, No. 3	21 00	.....
Carron, special	22 00	.....
Carron, soft	22 00	.....
Cleveland, No. 3	21 00	.....
Clarence, No. 3	21 00	.....
Glengarnock	25 00	.....
Summerlee, No. 1	25 00	.....
Summerlee, No. 3	25 00	.....
Michigan charcoal iron	25 00	.....
Victoria, No. 1	21 00	19 00
Victoria, No. 2X	21 00	19 00
Victoria, No. 2 Plain	21 00	19 00
Hamilton, No. 1	20 00	19 00
Hamilton, No. 2	20 00	19 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	2.20
Steel bars, f.o.b., Toronto	2.20
Common bar iron, f.o.b., Montreal	2.20
Steel bars, f.o.b., Montreal	2.20
Twisted reinforcing bars	2.20
Bessemer rails, heavy, at mill	1,25
Steel bars, Pittsburgh	1.25
Tank plates, Pittsburgh	1.25
Beams and angles, Pittsburgh	1.25
Steel hoops, Pittsburgh	1.40
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.10
Small shapes	2.35
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.90
Structural shapes	1.95
Plates	1.95

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, 1/4 to 1/2 in., 100 lb.	$2 35	$2 25
Heads, per 100 lb.	2 55	2 45
Tank plates, 3-16 in.	2 60	2 45

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$12 50	$12 50
Copper, crucible	14 50	14 50
Copper, unch-bled, heavy	14 00	14 00
Copper, wire, unch-bled	14 00	14 00
No. 1 machine, compos'n	11 50	12 50
No. 1 compos'n turnings	10 50	9 25
No. 1 wrought iron	6 00	6 00
Heavy melting steel	5 75	6 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings	12 00	12 00
No. 1 brass turnings	10 00	10 00
Heavy lead	4 50	4 75
Tea lead	$3 50	$3 50
Scrap zinc	12 00	13 00

W. I. PIPE DISCOUNTS.

Following are Toronto jobbers' discounts on pipe in effect June 25, 1915:

	Buttweld Black	Gal.	Lapweld Black	Gal.
Standard				
1/4, 3/8 in.	63	32½	....	....
1/2 in.	68	41½	....	....
3/4 to 1½ in.	73	46½	....	....
2 in.	73	46½	69	42½
2½ to 4 in.	73	46½	72	45½
4½, 5, 6 in.	....	....	70	43½
7, 8, 10 in.	....	....	67	40½
X Strong P. E.				
1/4, 3/8 in.	56	32½	....	....
1/2 in.	63	39½	....	....
3/4 to 1½ in.	67	43½	....	....
2, 2½, 3 in.	68	44½	....	....
2 in.	....	....	63	39½
2½ to 4 in.	....	....	63	42½
4½, 5, 6 in.	....	....	66	42½
7, 8 in.	....	....	59	35½
XX Strong P. E.				
1/2 to 2 in.	44	20½	....	....
2½ to 6 in.	....	....	43	19½
7 to 8 in.	....	....	40	16½
Genuine Wrot Iron.				
3/8 in.	57	26½	....	....
1/2 in.	62	35½	....	....
3/4 to 1½ in.	67	40½	....	....
2 in.	67	40½	63	36½
2½, 3 in.	67	40½	66	39½
3½, 4 in.	....	....	66	39½
4½, 5, 6 in.	....	....	63	36½
7, 8 in.	....	....	60	33½

Wrought Nipples.

4 in. and under	77½%
4½ in. and larger	72½%
4 in. and under, running thread	57½%

Standard Couplings.

4 in. and under	60%
4½ in. and larger	40%

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65%
Sq. Head Set Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45%
Flat & But. Head Cap Screws	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in. N.	70%
Semi-Fin. Nuts up to 1 in.	70%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

METALS.

	Montreal.	Toronto.
Lake copper, carload	$21 00	$21 00
Electrolytic copper	20 75	20 75
Castings, copper	20 50	20 50
Tin	41 00	41 00
Spelter	23 00	23 00
Lead	7 00	7 00
Antimony	40 00	40 00
Aluminum	40 00	40 00

Prices per 100 lbs.

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh	$22 00
Openhearth billets, Pittsburgh	22 00
Forging billets, Pittsburgh	28 00
Wire rods, Pittsburgh	25 50

NAILS AND SPIKES.

Standard steel wire nails, base	$2 40	$2 35
Cut nails	2 50	2 70
Miscellaneous wire nails	75 per cent.	
Pressed spikes, 5/8 diam., 100 lbs.		2 85

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	75
Stove bolts	80
Plate washers	40
Machine bolts, 3/8 and less	70
Machine bolts, 7-16 and over	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes	4¼c per lb. off
Nuts, Hexagon, all sizes	4¾c per lb. off
Iron rivets	72½ per cent.
Boiler rivets, base, 3/4-in. and larger	$3.25
Structural rivets, as above	3.25
Wood screws, flathead, bright	85, 10, 7½, 10 p.c. off
Wood screws, flathead, Brass	75 p.c. off
Wood screws, flathead, Bronze	70 p.c. off

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong, Sizes Ins.	Price per ft.	D. Ex. Strong, Size Ins.	Price per ft.
1/8 in	$ .05½	1/8 in	$ .12	1/2	$ .32
1/4 in	.06	1/4 in	.07½	3/4	.35
3/8 in	.06	3/8 in	.07½	1	.37
1/2 in	.08½	1/2 in	.11	1¼	.52½
3/4 in	.11½	3/4 in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼ in	.23½	1¼ in	.30	2½	1.37
1½ in	.27½	1½ in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½ in	.58½	2½ in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½ in	.92	3½ in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½ in	1.27	4½ in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.....
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....

COKE AND COAL.

Solvay Foundry Coke	$5.75
Connellsville Foundry Coke	4.85-5.15
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

COLD DRAWN STEEL SHAFTING.

At mill	45%
At warehouse	40%

Discounts off new list. Warehouse price at Montreal and Toronto.

MISCELLANEOUS.

Solder, half-and-half	.26¾
Putty, 100-lb. drums	2.70
Red dry lead, 100-lb. kegs, per cwt.	9.67
Glue, French medal, per lb.	0.18
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.18
Benzine, single bbls., per gal.	0.18
Pure turpentine, single bbls.	0.66
Linseed oil, raw, single bbls.	0.67
Linseed oil, boiled, single bbls.	0.70
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Lead wool, per lb.	0.10
Pure Manila rope	0.16
Transmission rope, Manila	0.20
Drilling cables, Manila	0.17
Lard oil, per gal.	0.73
Union thread cutting oil	0.60
Imperial quenching oil	0.35

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto 40%

PROOF COIL CHAIN.

¼ inch	$8.00
5-16 inch	5.35
⅜ inch	4.60
7-16 inch	4.30
½ inch	4.05
9-16 inch	4.05
⅝ inch	3.90
¾ inch	3.85
⅞ inch	3.65
1 inch	3.45

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	60
Carbon over 1½ in.	25
High Speed	40
Blacksmith	60
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Centre	25
Pipe Reamers	80

Discounts off standard list.

IRON PIPE FITTINGS.

Canadian malleable, 35 per cent.; cast iron, 60; standard bushings, 60; headers, 60; flanged unions, 60; malleable bushings, 60; nipples, 75; malleable, lipped unions, 65.

TAPES.

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3.50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$3 00	$2 90
Canada plates, dull, 52 sheets	3 25	3 50
Canada Plates, all bright	4 40	4 60
Apollo brand, 10¾ oz. galvanized	6 40	5 95
Queen's Head, 28 B.W.G.	6 50	6 50
Fleur-de-Lis, 28 B. W. G.	5 75	5 75
Gorbal's Best, No. 28	6 50	6 50
Viking metal, No. 28	6 00	6 00
Colborne Crown, No. 28	5 38	5 30

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$11 00	.....
1¼ in.	11 00	.....
1½ in.	11 00	.....
1¾ in.	11 00	.....
2 in.	11 50	9 20
2¼ in.	13 00	.....
2½ in.	14 00	12 10
3 in.	16 00	12 70
3¼ in.	.....	13 90
3½ in.	20 00	15 00
4 in.	25 50	18 90

Prices per 100 feet, Montreal and Toronto.

WASTE.

WHITE.	Cents per lb.
XXX Extra	0 10¼
X Grand	0 09¾
XLCR	0 09¼
X Empire	0 08½
X Press	0 07¾
COLORED.	
Lion	0 07⅛
Standard	0 06⅜
Popular	0 05¾
Keen	0 05¼
WOOL PACKING.	
Arrow	0 16
Axle	0 11
Anvil	0 08
Anchor	0 07
WASHED WIPERS.	
Select White	0 09
Mixed Colored	0 06¼
Dark Colored	0 05¼

This list subject to trade discount for quantity.

BELTING RUBBER.

Standard	50%
Best grades	30%

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50%
Standard	50 & 10%
Cut leather lacing, No. 1	$1.20
Leather in sides	1.10

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	$9.00
¼ in.	6.25
5-16 in.	4.65
⅜ in.	4.00
7-16 in.	4.00
½ in.	4.00

Prices per 100 lbs.

PLATING CHEMICALS.

Acid, boracic	$ .15
Acid, hydrochloric	.05
Acid, hydrofluoric	.06
Acid, Nitric	.10
Acid, sulphuric	.05
Ammonia, aqua	.08
Ammonium carbonate	.15
Ammonium chloride	.11
Ammonium hydrosulphuret	.35
Ammonium sulphate	.07
Arsenic, white	.10
Copper sulphate	.10
Cyanide of potassium (95 to 96%)	.35
Iron perchloride	.20
Lead acetate	.16
Nickel ammonium sulphate	.10
Nickel carbonate	.50
Nickel sulphate	.20
Potassium carbonate	.40
Potassium sulphide	.30
Silver chloride (per oz.)	.65
Silver nitrate (per oz.)	.45
Sodium bisulphite	.10
Sodium carbonate crystals	.04
Sodium cyanide	.35
Sodium hydrate	.04
Sodium hyposulphite (per 100 lbs.)	3.00
Sodium phosphate	.14
Tin chloride	.45
Zinc chloride	.20
Zinc sulphate	.08

Prices Per Lb. Unless Otherwise Stated.

ANODES.

Nickel	.47 to .52
Cobalt	1.75 to 2.00
Copper	.25 to .28
Tin	.45 to .50
Silver	.55 to .60
Zinc	.30 to .33

Prices Per Lb.

PLATING SUPPLIES.

Polishing wheels, felt	1.50 to 1.75
Polishing wheels, bullneck	.80
Emery in kegs	.4½ to .06
Pumice, ground	.05
Emery glue	.15 to .20
Tripoli composition	.04 to .06
Crocus composition	.04 to .06
Emery composition	.05 to .07
Rouge, silver	.25 to .50
Rouge, nickel and brass	.15 to .25

Prices Per Lb.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Toronto, Ont., Aug. 10, 1915.—There is little change to note in the industrial situation, conditions being much the same as during the last few weeks. Compared with conditions prevailing one year ago, the business outlook is favorable, and the steady improvement in trade is distinctly encouraging. Perhaps the most interesting feature is the improvement in the steel trade. Twelve months ago, conditions in the steel trade were very quiet and production had fallen off considerably. Now the mills are very active, and working almost to capacity. Production is practically all on account of the war. The crop reports generally are very favorable, and if the yield is as good as is anticipated, it will be of the greatest benefit to the country.

The trade returns for the Dominion for the last fiscal year recently published by the Department of Trade and Commerce contain some interesting figures. The imports of merchandise fell off by nearly 163 million dollars, as compared with 1914, while the exports showed an increase of a little more than four millions. The encouraging feature, however, is the fact that for the first time in many years the balance of trade in regard to exports and imports is in Canada's favor. This condition is, of course, entirely as a result of the war. The increase in exports of manufactured goods being one of the principal reasons for the favorable trade balance.

Steel Market.

The outlook in the steel trade continues to improve, which is due almost entirely to war business. Canadian mills are operating almost to capacity, and, in addition to the output of forgings and bars for shells, are producing other steel products, both finished and semi-finished.

It is reported that negotiations are pending between the Dominion Steel Corporation and the French Government for a large order of finished shells. It is understood that, while nothing has been definitely settled, a contract will be signed at an early date. If this business is closed the outlook in the shell industry will improve considerably, as it may lead to other orders for shells being placed here in addition to those being handled by the Shell Committee. It is rumored that the Russian Government has awarded another large contract for shells to the Canadian Car and Foundry Co. In any case it is extremely probable that it will be distributed among the same concerns in the States as the previous contract, and so will not be of any particular interest to manufacturers on this side of the line.

Prices on bars, plates, and small shapes are holding very firm, and higher prices for Pittsburgh products may be expected any time. Boiler tubes have advanced approximately $1 per 100 feet. Wrought iron pipe is very firm and an advance is expected in the near future. Galvanized sheets are easier to obtain, and spelter has declined somewhat. Some makers are still out of the market, and are only filling up old contracts. Prices of galvanized sheets are unchanged but have an easier tendency. The black sheet market is steadily gaining strength and quotations are firm with an upward tendency.

The high-speed tool steel situation is acute, and fears are expressed that the shortage will be very serious, if it has not already become so.

The conditions in the steel trade in the States continue to improve, and big business is being done in rounds for shells. Mills are so well supplied with orders for bars that they are conservative about taking on any more tonnage, although large orders are offering from foreign countries. The market is well established at $1.30, Pittsburgh, and it is expected that $1.35 will soon prevail.

OUR EMPIRE COHESION.

It needed this one supreme struggle to teach the world that when an enemy grappled with the British Empire, or part of the Empire, he grappled with the whole. The British Empire is stronger to-day than ever before. It will signalize to neutrals that it is more than a name; it will demonstrate that the one great unity is to be reckoned with as a whole, and not in sections. The Empire will be a power for peace that never existed before, and go far to solve the international relations of the world.

Pig Iron.

Furnaces connected with steel plants continue active, but the demand for foundry iron is light. The pig iron situation is improving in the States, and prices have a higher tendency.

Scrap Metals.

The market for heavy melting steel is active, and quotations firmer. Prices of copper and brass scrap are holding firm on good demand. Scrap lead is quiet, and prices have a weaker tendency. Zinc is quiet, and unchanged.

Machine Tools.

There is no change in the machine tool situation, and business is quieter after the recent spell of great activity. Inquiries are being sent out by firms contemplating making shells, but few orders have been placed except by those firms already engaged in making shells who are adding to their equipment. Makers of machine tools are very busy, and deliveries are still very backward. Dealers are not idle, however, by any means, as they fully expect increased activity later, and are making preparations to meet the demand as far as possible.

Supplies.

Business continues brisk in machine shop supplies. Prices are holding firm, and there are few changes of importance to note. Transmission rope is now being quoted at 20c per pound. The linseed oil market is unsettled, but prices are unchanged. An advance in the price of white waste will probably be announced very shortly.

Metals.

Continued weakness characterizes the metal markets. There has been no sign of a recovery during the week, and the weakness has been further intensified in the London market by the depression following the fall of Warsaw. While this loss indicates that the war will be prolonged and therefore increases demand for munitions and their many dequirements, yet for the time being these facts have been offset by the psychological aspect of the situation. The metals principally affected are tin, copper, spelter and lead, which have all declined in London, and also locally, with the single exception of copper, which, although dull, is unchanged. The antimony spot market is easier, but quotations are unchanged. The volume of business continues good, and compares very favorably with conditions prevailing twelve months ago, altogether apart from the increase in the demand for metals for munitions.

Tin.—The market in London is depressed and has declined again. Conditions in the States are good, but the New York market has been affected in sympathy with London. There is some scarcity of spot tin, and if there were a better tone in the market, a recovery might be expected. Tin has declined 1c, and is quoted locally at 41c per pound.

Copper.—The depression caused by the fall of Warsaw has unsettled the market, but quotations have been maintained. The prospect of a war of longer duration improves the position of cop-

per owing to the consequent larger demand for this metal. The market is dull and prices are unchanged at 21c per pound.

Spelter.—The market is weak, and lower with little buying. There is an entire absence of inquiry, and efforts to draw bids from buyers have met with little success. The scarcity of spot spelter has been largely overcome by the output of the smelters. Export orders have dropped off, and although these have been large over recent months, the shipments represent orders placed some time ago. Spelter has declined 2c and quotations are nominal at 23c per pound.

Lead.—There is practically no demand for lead. and the market is weak. It is extremely probable that the "Trust" will have to reduce their prices. Local prices have declined ¼c. and quotations are nominal at 7c per pound.

Antimony.—The spot market is easier, but there is a good inquiry for extended futures. Supplies of antimony are easier to obtain, but quotations are unchanged. and nominal at 40c per pound.

Aluminum.—There is no improvement in the situation as regards scarcity of aluminum. The market is firm and quotations nominal at 40c per pound.

St. John, N.B., August 7.—A practical suggestion for the speeding up of munitions supplies in Canada, at least so far as St. John is concerned, was heard by D. A. Thomas, former Welsh M.P., now touring Canada as special representative for Lloyd George, when he visited this city yesterday. Should the suggestion be adopted, it would have a far-reaching effect upon the city in the way of employment, besides contributing to the increased output of supplies of war.

In his inspection of the lately installed plant in the local Exhibition Buildings, Mr. Thomas was told by George McAvity, of T. McAvity & Sons, Ltd., that his firm intended to treble its output of shells and its proposed plant if sufficient orders were received. Beyond that, Mr. McAvity offered to the War Office the advantages of the whole expenditure to date on the plan and foundations of the site that T. McAvity & Sons, Ltd.. have acquired in Marsh Road, and of the firm's whole technical experience, if they wanted to erect a special factory for munitions. The offer was unconditional, except that the buildings and site should revert to the firm at the close of the war.

Some idea of the vastness of the offer may be gleaned from the fact that already upwards of $10,000 has been spent in preliminary work by the firm for iron and brass foundry purposes. Mr. McAvity particularly impressed upon the visitor the advantages in the way of shipping from an ice-free port, open all the year round, and said that if agreed upon, the new works could be in operation by next December, a matter of only a few months. The offer was heard with attentive interest by Mr. Thomas, who will report upon it.

Mr. Thomas while in St. John visited the various factories and foundries where war supplies are being manufactured, including those of T. McAvity & Sons, James Fleming, the Wilson Box Factory, and others. He did the same in Moncton, New Glasgow, Halifax and other centres in the Maritime Provinces. Speaking of Canada's share in manufacture of materials, he said that the progress made had been most remarkable. The only plant of its kind in Canada, a year ago, had been the small arsenal at Ottawa, employing about three hundred men. To-day more than one hundred towns, villages and cities through the Dominion were engaged in making supplies for war purposes. In view of the tremendous sacrifice Canada was making, he said, the British Government felt she should have all the war orders possible, especially since she had shown herself well able to meet them.

A New Elevator.

General Manager Gutelius, of the Government Railways, was in St. John this week, and was interviewed by a delegation from the Board of Trade. He assured them of pending improvements at this port as soon as finances were bettered, and of particular interest to St. John and Canada as a whole, he made the statement that a new elevator was to be erected here, not far from the Atlantic Sugar Refinery in Lower Cove. The new facilities would include also two piers 750 feet long. The elevator would replace that which was destroyed by fire last summer, and which would not be rebuilt on the old site because of other plans being had for work there.

Patriotic Endeavor.

The officials and employes of Rhodes, Curry Co., of Amherst, with their branches at Halifax, New Glasgow, and St. John, have contributed $1,000 to a fund for the purchase of a machine gun for the Militia Department at Ottawa. The certified check for the amount has been forwarded.

For the collection of a million-dollar fund for the care of wounded Canadian soldiers a practical suggestion has been made by W. E. Roop, foreman in the woodworking department of T. S. Sims & Co., brush manufacturers, St. John. He has put forth the suggestion that every working man in Canada give one day's pay to the fund, and thinks that in this way enough could be raised for the purpose.

Contracts Let.

A. R. C. Clark & Son, of St. John, have been awarded the contract for the installation of water and sewerage in Bathurst, N.B. The contract covers about $131,000, including the construction of a dam and pumping station, and about seven miles of water and sewage mains. A large stand pipe with a 405,000 gallon capacity is to be erected also.

E. W. Green has been awarded the contract for the erection of a new steel and concrete garage in Carleton Street, St. John. The site is 120 feet by 87, and it is reported that the purpose is to establish a line of jitneys here.

The contract for a new sewer in Lancaster has been given to Messrs. Kane & Ring. It represents an expenditure of about $10,000.

W. J. Hunter, of Sussex, has been awarded the contract for the erection of a large dam at Campbellton for the Shives Lumber Co. It will be about 175 feet long and 32 feet high.

CANADA'S TRADE POSITION.

THE trade returns of the Dominion for the last fiscal year, just published, reflect the general trade restriction both before and during the war up to March 31 last. As compared with the preceding year, there was a net decrease of about 158 millions in the exports and imports of merchandise. Imports of merchandise fell off by nearly 163 million dollars as compared with 1914, while exports of merchandise showed an increase of a little more than four millions.

It is encouraging to note, however, that for the first time in many years the balance of trade for the year in regard to imports and exports of merchandise is in Canada's favor, the total imports being $455,471,471, while exports are valued at $461,442,509.

The movement of coin and bullion, which was abnormal following the outbreak of the war, of course swells the total figures very considerably. The imports of coin and bullion during the last fiscal year amounted to no less than $131,992,992, as compared with $15,236,305 for the preceding year.

British Imports.

Canada's imports from the British Empire for the year totalled $116,272,787, a decrease of nearly forty millions as compared with the preceding year. Imports from Great Britain, which totalled $90,085,840, fell off by nearly forty-two millions. Imports from the British West Indies, however, increased by nearly two millions. Imports of merchandise from the United States last year totalled $296,632,506, a decrease of nearly a hundred millions.

Exports to Britain.

Canada's exports to British countries during the year totalled $237,558,704, a decrease of nearly ten millions, nearly all of which was in exports to the United Kingdom. As compared with this, Canada increased her sales of Canadian produce to the United States by some ten millions, the total for the year being $173,320,798. During the year Canada bought from the United States 123 million dollars' worth of goods more than she sold to the United States. In the case of Great Britain, the Dominion sold 121 million dollars' worth of goods more than she bought.

The increase in exports of merchandise during the year was due solely to the increased transportation through Canada of foreign produce, which was greater by some twenty-eight millions than in the previous year, and was made up principally of horses, oats and wheat bought from the United States for war purposes and shipped through Canadian ports.

Canadian Produce Exports.

The exports of Canadian produce show a decrease of $22,169,603. Exports of the mine decreased from $52,039,054 in 1914 to $51,740,989 for 1915; the fisheries from $20,623,560 to $19,687,068; agricultural products from $198,220,029 to $134,746,050.

On the other hand, exports of animal produce increased from $53,349,119 to $74,390,743, and of manufactures from $57,443,452 to $85,539,501. The increase in the exports of animal produce reflects, of course, the large sales to the United States of beef cattle following the taking down by the United States of the tariff barriers. The increase in the exports of manufactures is largely due to Canada's sales of war munitions to the allies.

Foreign Trade.

The effects of the war are seen in the figures of the trade with France and Germany. Imports from France last year totalled $8,449,186, as compared with $14,276,378. Exports to France totalled $14,595,705, as compared with $3,810,562 for the preceding fiscal year. From Germany Canada bought during the twelve months goods to the value of $4,314,805, as compared with $14,586,223 for the preceding year. To Germany Canada sold last year goods to the value of $2,162,010, as compared with $4,423,736 in 1913-14. The total trade of Canada with Germany in 1913-14 amounted to $19,019,969. In 1914-15 it amounted to $7,248,996. This year it will be nil.

The Quebec Streams Commission are having a large dam built above the La Loutre rapids by the St. Maurice Construction Co. The dam will cost $1,425,000, and will probably be completed in 1918. Fraser, Brace & Co., of Montreal, will undertake the greater part of the work.

Principles of Laying—Off Cylindrical Intersections---III.

By J. W. Ross

The more or less special nature of the work involved in the making of sheet metal piping has caused many manufacturers to avoid this class of work, with the result that when a job has to be handled, there is frequently considerable unnecessary loss incurred through errors in laying off material. The examples treated by the writer of this article should form a valuable reference to many manufacturers on ordinary as well as special occasions.

TEE WITH INCLINED INTERSECTION.

THE perspective cut, Fig. 23, and the side and end elevation, Figs. 24 and 25, show a pipe intersecting a larger pipe at an angle of 60 degrees.

Construction.

With centre O and radius equal to 1 inch, describe the circle P Q^1 1^2 Q^1 Fig. 24. This representing the end view of a horizontal cylinder of 2 inches in diameter. Draw the centre line P, O, 7 at right angles to the horizontal line Q^1 O Q^1. Continue the centre line Q^1 O Q^1 Fig. 24 over to Q Q, Fig. 25. Make this equal to 2¾ inches. At an angle of 60 degrees to Q R Q draw the line R 4. Project the points 1^2 and P, Fig. 24 respectively to the line C D and A B drawn parallel to Q R Q. Draw A Q C and B Q D at right angles to Q R Q. Measure L 4^1 equal to 1¼ inches. Draw 1^1 4^1 7^1 right angles to R 4^1. Make 4^1 the centre of the diameter 1^1 4^1 7^1 which is equal to 1¼. Parallel with R 4^1 draw the lines 7^1 7^2 and 1^1 1^2 to their intersection of the line C D. With centre X describe the circle 1, 4, 7, 10, with diameter equal to the neutral diameter of the inclined pipe. Divide this neutral circumference into 12 equal parts. Project these points—parallel with R 4—through the line C D. In a suitable position on the centre line P 7, draw the neutral circumference with the centre X, Fig. 24. Divide this into the same number of equal spaces as was done in Fig. 25. Parallel to the centre line project all these points down to the intersection of the cylinder Q^1 1^2 Q^1 P. Number accordingly where these points intersect the cylinder Fig. 24, project over by parallel lines to the intersection of similarly numbered inclined lines in Fig. 25, locating the points 2^2, 12^2, 3^2, 4^2, etc. Fig. 25. A fair curve drawn through these points locates the mitre line, and the flange line for light riveted pipe.

Development.

Measure off 1^1 7^1 1^1, Fig. 26 equal to the length of the circumference of the circle 1, 4, 7, 10 in either Figs. 24 or 25. Divide this line into 12 equal spaces. Draw vertical lines through these points at right angles to the line 1^1 7^1 1^1, Fig. 26. Number these points in consecutive order and in relation to the position of the longitudinal seam. Evidently 1^1 1^1, Fig. 25 will be the most suitable position for this seam as regards the driving of the rivets.

Take the distance 1^1 to 1^2, Fig. 25 and transfer this over to Fig. 26. Also take the distances 2^1 2^2, 3^1 3^2 4^1 4^2 etc. Fig. 25 and transfer these over to their correct position in Fig. 26. Through these located points draw the mitre line. Add on a suitable amount for lap and draw in the rivet lines.

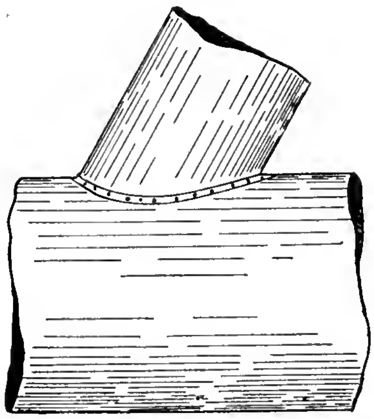

FIG. 23.

In the preceding problems the measurements of the elements, for transferring to the templet, may be taken from either the side or end elevations. Take for example Figs. 2 and 3. The measurement of the element 1^1, 1^2 Fig. 2 is equal to the measurement 1^1 1^2 Fig. 3. And 7^1 7^2 6^1 6^2 5^1 5^2 etc, Fig. 2 are all equal respectively to 7^1 7^2 6^1 6^2 5^1 5^2 etc. Fig. 3. In Figs. 24 and 25 this is not the case. The reason why will be briefly explained without going too deeply into the principles of projection. In both views Figs. 2 and 3, the centre line of the vertical cylinder intersects at right angles to the centre line of the horizontal cylinder. All lines parallel to the centre line in one view to that of the other, will show the true lengths of the lines. This condition meets the case of Figs. 2 and 3 as all the vertical lines in Fig. 2 are shown vertical in Fig. 3. Therefore the true length of similarly numbered lines are equal in each view. The true length of a horizontal line is shown by a straight line in one view and by a point in another. So in the case just stated it does not matter which view these measurements are taken from, providing they meet the conditions which were stated. In Fig. 24 the elements—1^1 1^2 2^1 2^2, etc.—are parallel with the centre line 7 P, also the elements—1^1 1^2 2^1 2^2 etc.—Fig. 3 are parallel with the centre line 4 R. But all the elements of one view are not parallel with all the elements of the other view. Therefore, the true length is not shown in both views. In Fig. 24 the centre line is shown at right angles to the horizontal line. But in Fig. 25 the centre line is shown at an angle of 60 degrees to the horizontal line. Therefore the elements will be foreshortened in Fig. 24 and their true lengths shown in Fig. 25. As will be observed, the true length of elements were transferred from Fig. 25 to the templet in Fig. 26. By the way if the vertical centre line in Fig. 24 had also been inclined to the horizontal line, then the elements in both views would have been foreshortened. The true length would then have to be found by construction. This construction method is termed triangulation, which will be explained in a forthcoming issue.

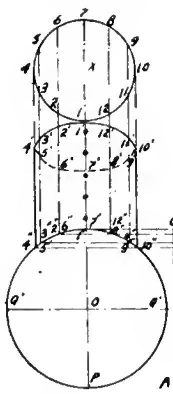

FIG. 24.

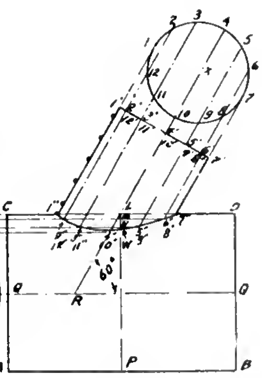

FIG. 25.

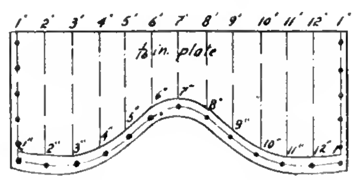

FIG. 26.

Development of the Intersected Pipe.

The diameter of the circumference P Q^1 1^2 Q^1 equals 2 inches. The stretchout will equal 2 × 3.14 which is 6.28 inches,

or slightly over 6¼ inches. Measure off B D B Fig. 27 equal to this distance, Bisect at D and raise the perpendicular D C. Measure along the curve the distances 1^2 2^2, 2^2 3^2, 3^2 4^2 etc. Fig. 24, and transfer over to 1^2 2^2, 2^2 3^2, 3^2 4^2 etc. Fig. 27. From these points draw lines parallel to the centre line C D which is also denoted by 1^2 7^2. Bisect A B at P Fig. 27. Draw the centre line P P. Where P P intersects the elements, letter as shown in Fig. 27.

Bisect A B Fig. 25 at P. Erect the perpendicular P L. Locate the points M N W at the intersection of this line

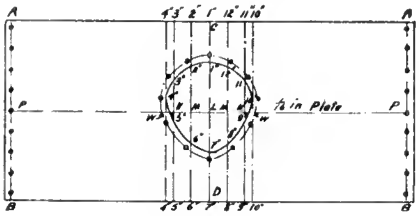

FIG. 27.

with the horizontal projection lines. Fig. 25. Set the dividers to the distance L 1^2 Fig. 25. Transfer to L 1^0 Fig. 27. Again set the dividers to L 7^2 Fig. 25. Transfer this distance to L 7^0 Fig. 27. Similarly take the distances M 6^2, M 8^2, M 2^2, M 12^2, N 3^2, N 11^1, N 5^2 N 9^2, W 4^2 W 10^2, and transfer to their allocated lines in Fig. 27. Draw a fair curve through these points to define the opening of the cylinder.

Draw in the rivet line and space off the rivet centres at the proper distance from the edge of the opening. Divide A B into a suitable number of rivet centre spaces. Transfer these centres to its connecting seam A B. Add the laps to complete the templet.

BLANKING AND FORMING DIES FOR PATENT HOSE HOLDER.

By Spring Craig.

In figure No. 1, at A, is shown a patent hose holder of cast brass to be used for holding hose when sprinkling lawn. In B, drawing 1, another view of K is shown. This part is to be placed in the ground and the swivel or knuckle joint is to allow the nozzle or sprinkler to be turned in any direction and clamped by the wing nut shown. The wing nut clamps the two parts h on the two pieces gg, thereby clamping these pieces firmly on the hose f. A pin through the end keeps the two pieces h from swivelling. At J, the two ends of gg are formed into half spheres, with a projecting ring cast on one and a recess in the other. This is to keep them in line when changing the hose from one position to another. As these had to be sold at a low price, it was not feasible to make them of brass, for the weight of brass in each one, along with the time taken to mould them, would be considerable. They could have been made by die-casting methods with the proper mixture, but being a new article, and with the extent of the demand unknown, it did not justify the cost of die-casting dies to commence with. The final conclusion was to make them of sheet metal in blanking and forming dies. The next question to decide was the weight and kind of material.

Selecting Suitable Stock.

Experiments were tried with different thicknesses of soft sheet steel to arrive at an idea of how light they could be made and yet strong enough to serve the purpose. The weakest point would be at the wing nut on account of the clamping and the hole for the wing nut weakening the stock. It was found that No. 15 B. & S. gauge, which equals .057 of an inch, was about the lightest that could be used. It does not take long for the cost of a slight difference in the thickness or weight of stock, considering the scrap along with the amount actually used to amount to a considerable sum. Sometimes through modifying or slightly changing the design of the article the price of the dies and more can be saved, providing any considerable quantity are required. Often it is possible to arrange the lay-out of piercing and blanking dies and simple blanking dies, so that by

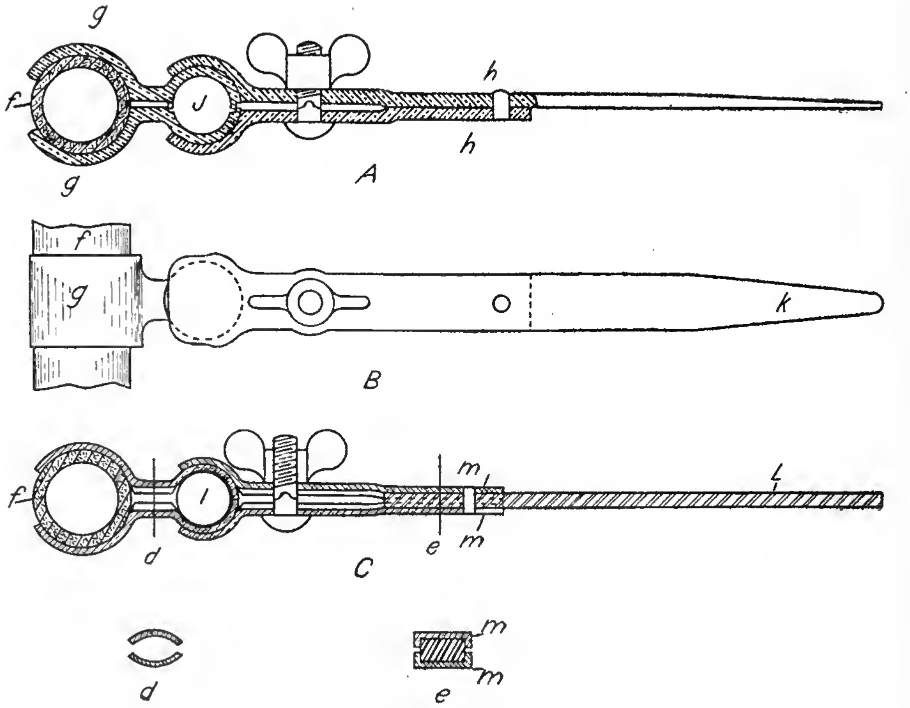

FIG. 1. PATENT HOSE HOLDER.

blanking out every other one, then reversing the stock and running the stock through the dies again, the amount of scrap can be cut down to the lowest possible amount. One difficulty, which eventually proved to be much simpler than appeared at first, and which held up proceedings for some time, was how to keep the two pieces gg in line without making an extra set of dies. As a certain amount was stated as being the probable cost of the dies, these extra dies would not be possible.

It was suggested that a marble be placed between as at 1 in C, figure 1. This served the purpose admirably of keeping them in line. Otherwise the sheet metal hose holder was designed as shown at C, figure 1, longitudinal section, d and e cross sections. The neck was curved, as shown in cross section at d, for strength. For the long tapered part at L, a piece of 5/16 x ½-in. stock was used, tapered at one end, and held between the two pieces mm by a rivet.

Determining Proper Size of Blank.

The size and shape of the blank used in the forming dies has generally to be obtained by experiment, especially if the design is in any way complicated. The forming dies are always made first, and the experimental work is done with the dies soft in order to be able to change them if necessary. First a blank is laid out by figuring and judgment, and two blanks are cut out. One is formed up in the forming dies, and the result will show where the remaining blank has to be changed. Before forming this second blank, a duplicate of it should be made, and if a third blank has to be used for trial, a fourth blank should be made, which would be an exact copy of blank number three before forming. When one is at last formed up satisfactorily, there is a correct template left to lay-out the blanking die by. At A B C D, figure 3, are different views of the forming dies for part m in C, figure 1.

F E are the punches held in a steel pad. B is the forming die; a and b are pins actuated by spring and washer shown to push out the formed piece. On top of the die is a locating piece I machined

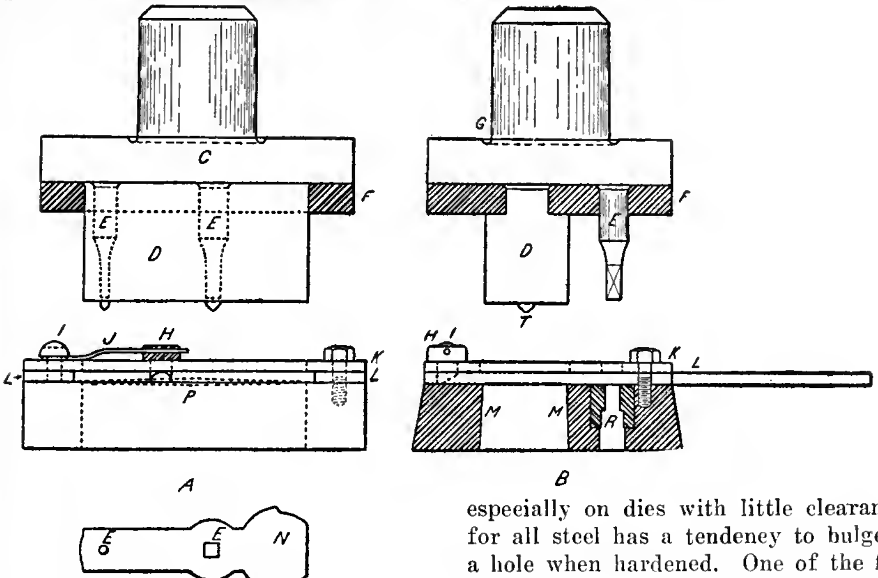

FIG. 2. PIERCING AND BLANKING DIE.

out to fit the blank at different points to properly locate it. The bevel at J J is usually made from 5 degrees to 15 degrees. Common practice is 10 degrees.

The forming die for piece g, figure 1, is constructed on the same principle, but to suit the different shape. The radius of the corner should never be less than the thickness of the stock, and should be highly polished on those parts over which the stock has to bend when being forced into the die by the forming punch. If the sides of the formed article are cut and scratched, the round or radius is not large enough. After the forming die is finished, the next step is the blanking die. On figure 2 at A and B is the blanking die for piece N, that is a duplicate of the one that formed up satisfactorily, as shown at m in figure 1.

A Gang Die.

This type is usually known as a gang die because, while punch D is blanking the article, the small punches E E are piercing the stock for the next blank, so that each time the stock is fed ahead, or at each stroke of the press, there is one piece pierced and one piece blanked. To proceed in the best manner is to work out the blanking die first and lay-out the holes for the piercing dies from it. When it is desired to get the greatest amount of work out of a die, the clearance or taper from the bottom to the top or cutting edge is only about four thousandths on a side. The writer has seen dies that were an inch thick when new used, until there was only three-sixteenths of them left. When there is only a limited number of blanks required, one-half to one degree clearance can be given. At M M on cross section B, in figure 2, if the clearance is made a little hollow, a whole lot of trouble and annoyance will be saved, especially on dies with little clearance; for all steel has a tendency to bulge in a hole when hardened. One of the first blanking dies the writer made burst in use through punchings clogging and jamming. Later, half a day or more had to be spent oilstoning clearance after hardening.

Bushings are used for the piercing dies, providing that the die will be used extensively, as they get dull quicker than the blanking die. At L the back guide for the stock extends for three or four inches to facilitate keeping the stock in line. K is the stripper fastened to the die by dowels, which are made of stubs steel, which pass through the guides L, and is held down by hexagon screws.

The stop H, under which the stock is pushed and pulled back against, is an improvement on the style of stop which

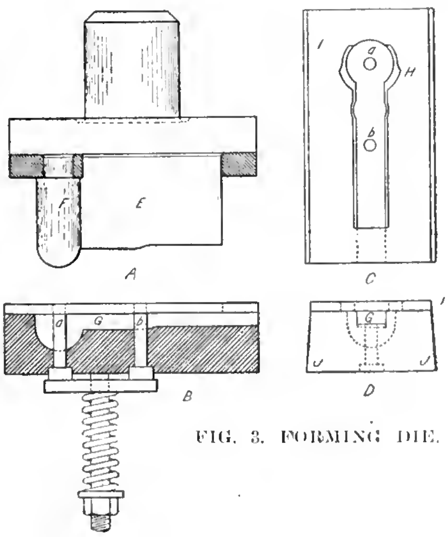

FIG. 3. FORMING DIE.

is fixed in the die, and over which the stock has to be lifted.

The spring J, made preferably of piano wire, keeps a downward pressure on the stop.

Hardening the Die.

In hardening the die, if the heating is done slowly, especially at the start, and evenly to the proper hardening heat, then dipped edgewise perfectly square, as shown in figure 5, and moved slowly back and forward in the water until it is cool enough to bear the hand before withdrawing, little trouble will be experienced with reliable makes of tool steel or cast steel. The die then should be immediately polished and drawn down to the desired temper. All screw and dowel holes should be plugged with fire clay or asbestos. The idea in moving the die back and forward is to allow the water to pass through the die, thereby eliminating the possibility of steam and air pockets forming, which will cause part of the cutting edge to be soft. In dipping, the heavy side is entered first, because it takes longer to cool than the light side; also being heavier and stronger when cooled first, the light side being still warm, has a chance to conform to shrinkage, etc., set up by the

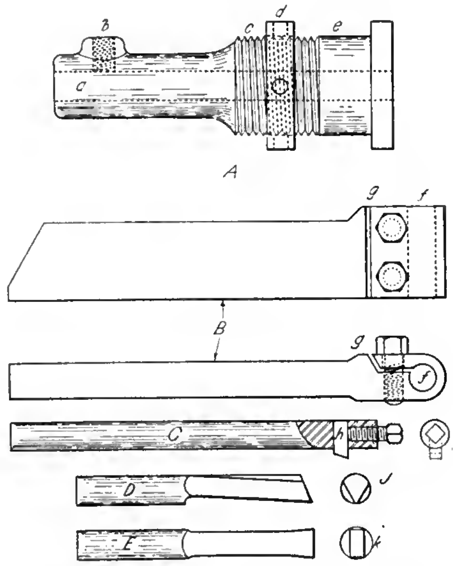

FIG. 4. SPECIAL SHAPER TOOLS FOR DIE MAKER.

heavy side. If the order were reversed and the light side dipped first, what happens is that the light side sets—then the stronger and heavier side alters, shrinks and warps—there are strains set up in the die; and, as the lighter side is set, it cannot give, and bearing the weakest part, it is where the fracture occurs. Soap, oil, etc., should not be in the water, as they will cause uneven hardness, a little potash bites or cools quicker. For dies on tin work, salt in the hardening water causes the tin work formed up in the dies to rust; and if the dies are stored in any kind of a damp place the dies will rust.

Fitting the Punches.

In most up-to-date shops the punches are held in a steel pad, as shown. The steel pad is doweled to the cast iron

punch holder and secured by flat-head screws. The large punch is always fitted first. The piercing punches should be a little more than the thickness of the stock, shorter than the blanking punch, for the reason that the blanking punch draws the stock and also binds it some, especially when the dies have shear. By shear is meant that the top or cutting face instead of being planed flat is planed either concave or convex, as shown by dotted lines, as at P in A, figure 2; this shear makes an easier working die. In spacing the blanks, there should not be less than the thickness of the stock in width around the blanking punch to do away with the tendency of the scrap turning edgewise, forcing the punch to one side, causing injury to the die.

The punch is only hardened about half-way up, leaving the top end soft, which allows of its being riveted into the pad. When dipping in the water for hardening, it is advisable to keep moving the punch up and down. If this is not done, and the punch held stationary, there is likely to be a water crack at the point reached by the top of the water.

The punch should always be drawn or tempered softer than the die. It is not known generally to mechanics that it is not the actual cutting of stock by the die that dulls it so much as the punch, owing to the press-ways being loose or worn, or through slight differences in thickness or hardness of stock, causing the punch to deflect from one side to the other, and thereby injuring the die. In sub-press dies, where punch and die are held rigidly in line and dies prevented absolutely from creeping by hardened and ground pins fastened in the bolster and passing through hardened bushings in the punch holder, the dies will do a great deal more work between grindings. There was .0015 clearance all around between the punch and die. A certain amount of clearance is always allowed between the punch and die for piercing and blanking. One-thousandth clearance for stock, one-sixty-fourth thick up to ten-thousandths for stock one-quarter of an inch thick.

Special Tools.

In figure 4, are samples of diemakers' tools for the shaper to facilitate this work, and which can also be used to advantage on other jobs. At A, figure 4, is a tool holder that is used in the clapper block in place of the regular shaper tool holder. The cutting tool is held in (a) by a set screw in b. At d is a collar threaded on to the body e, which locks the tool holder securely in place when tightened. The clapper block is held from moving by a set screw in the side of the clapper box. A hole has to be drilled and tapped in the clapper box for this set screw, as new shapers never have one, but it does not in anyway affect the working of the shaper when not in use for this special purpose.

At B is another style of holder that can be used in the regular tool holder. Cutter bar C, containing cutter h, can be used for die work, but is especially handy in a small shop for cutting keyways. At D and E and J and K are styles of tools most commonly used on dies, and can be held in either tool holder A or B. Tool holder B is made of machine steel, case-hardened around f in order that when the binding screws are released it will readily spring open, allowing the operator to turn the tools any desired angle. These clamping screws do not need to be tightened to the limit, for if by an accident the tool is fed in too deep or is caught, it slips back through and does no harm. Stubs steel is used, and by making suitable split bushings, any desired size of tool can be used.

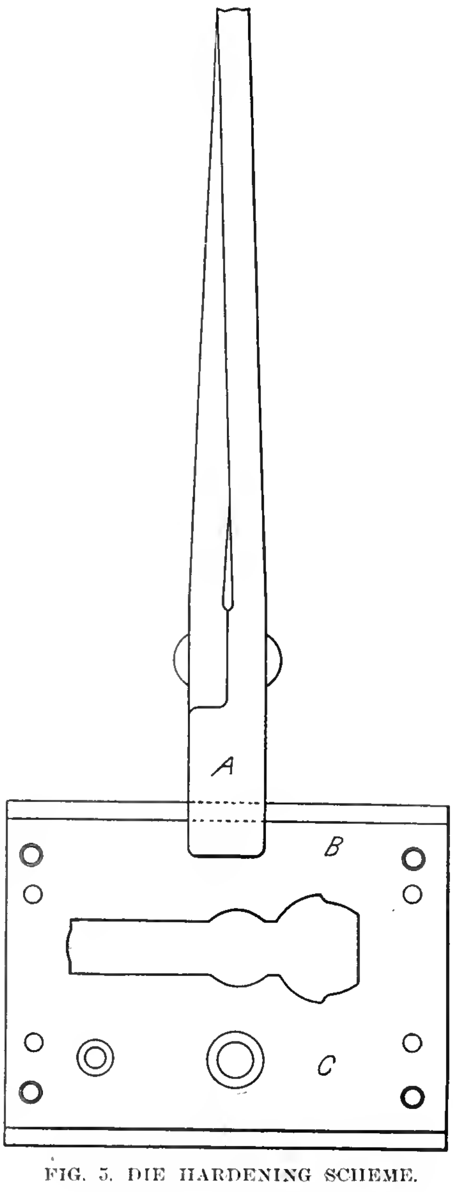

FIG. 5. DIE HARDENING SCHEME.

METAL SHIPMENTS.

SHIPMENTS of brass bars, plates and sheets from the United States in May were more than twelve times those of the preceding May, while for the eleven months ended May they were seven times as great as in the previous corresponding period. This is another illustration of the reversals that have taken place in those metals that are used for ammunition making. The following table gives the U. S. exports of brass, in pounds:

	—May— 1915.	1914.
Scrap, old	1,205,848	1,730,563
Bars, plates, etc..	5,941,185	474,411
	—11 mos. ended May— 1915.	1914.
Scrap, old	15,174,777	22,994,683
Bars, plates, etc..	35,322,141	5,078,608

A metal which has been revolutionized, as far as exports are concerned, is zinc. Exports of U. S. zinc in May, in the shape of pigs, bars, etc., were 15,270,854 ponnds, to which should be added 2,207,903 pounds of zinc from foreign ores smelted in that country, against a total of 214,201 pounds shipped in May, 1914. For the eleven months ended last May, exports of zinc, foreign and domestic, totaled 257,408,584 pounds compared with 3,737,647 for the corresponding period of the previous year.

PERFECTING INDUSTRIAL MATERIALS.

AT the present stage of development, the efficiency not only of workers but of what they work with is a matter of great concern to the world's engineers. The thoughts and efforts of thousands of men are being directed simply to removing the dangers of unsound structural materials. Failure may come even without the stresses of actual service, the problems of ensuring reliability being many and difficult. Condenser tubes of brass, for instance, have been observed to crack simply when stored up in the yard, and some articles of this metal become so altered under atmospheric influences as to crumble between the fingers. Serious internal strains also are developed by unfavorable conditions. A special study has been made of the faults arising from the cold-working of metals—cold-drawing, cold-rolling, cold-hammering, etc.—and it is found that these strains may closely approach the resisting power of the metal. Unforeseen failure may be caused by very slight external causes, such as scratching, unequal heating or cooling, or apparently insignificant corrosion.

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NOTES ON BEARINGS.

By H. Womersley.

THE design of bearings of all kinds is a most important problem connected with machine construction. A journal should be designed of such a size and form that it will run cool, and with practically no wear. Heat and wear are the results of friction; therefore we must define friction. Friction is the force acting between two bodies at their surface of contact when being pressed together, and which operates to prevent their sliding upon each other.

Bearings operating under ordinary working conditions warm up until the heat radiated equals the heat generated. They will remain at that temperature, provided there is no change in lubrication, load or speed.

Suitable Oils Necessary.

The pressure which any bearing will stand without seizing depends largely on the temperature, velocity of rubbing, and quality and description of lubricant in use. The lower the temperature the greater the pressure, and the higher the velocity of rubbing the less the pressure. This is due to the fact that oils become thinner and more free flowing as higher temperatures are reached, and consequently more easily squeezed out of the bearing.

A very light oil is liable to be squeezed out at a pressure as low as 50 or 60 lbs. per square inch, whilst a heavy cylinder oil will possibly stand a pressure of 1,000 lbs. per sq. in. The advantage of selecting suitable oils is, therefore, apparent. When a load is unvarying in amount and direction, the oil film is easily broken, but in cases where the load is variable in amount and direction, as in railway car journals and crank pins, the oil film is much more durable.

It has been ascertained that the lubricant in railway car journals, where the force varies continually in amount and direction, will stand twice the amount of pressure of the steady fly wheel journal, and in a crank pin, where the load reverses every revolution, the film will withstand three times that of the steady fly wheel pressure.

A bearing may give poor satisfaction, because it is too long, as well as because it is too short. Almost every bearing is in the condition of a loaded beam, and, therefore, it has some deflection. We will take the case of an overhung crank pin, in order to examine the phenomena occurring in a bearing under these circumstances.

When the engine is first run, both the pin and bushing are truly round and cylindrical. As the pin deflects under the load, the pressure becomes greater on the side toward the crank web, breaking down the oil film at that point, and causing heat. After a while the bushing

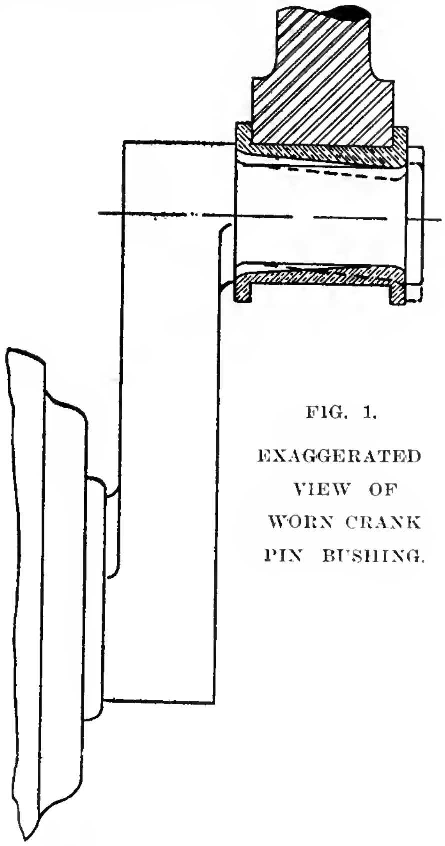


FIG. 1. EXAGGERATED VIEW OF WORN CRANK PIN BUSHING.

becomes worn to a slightly larger diameter at the side toward the crank, in the manner shown in Fig. 1. This is, of course, an exaggerated idea of the conditions of affairs in the crank pin bushing under load.

Requirements for Success.

For successful working, the bushing and pin must be accurately machined, and may, therefore, vary within narrow limits. The bushing must be a trifle larger than the pin. Should the pin be too large, the oil film will be too thin and easily ruptured. On the other hand, should the pin be too small the bearing surface becomes concentrated at a line, and the greater unit pressure at that part ruptures the film.

This is exactly what happens when the pin is too long. The bushing rapidly wears large at the inner end, and the pressure becomes concentrated along a line as a consequence. The lubricating film then breaks down, and the pin heats and scores. That there is always an element of doubt in regard to bearings is evidenced by the fact that our modern engine builders usually deliver an extra set of bearings with the engine, so that in the event of trouble a new set is at hand.

Workmanship Largely Responsible.

The workman plays a great part in the efficiency of a bearing. Investigation has shown the following to be the main reasons for hot bearings:—

1.—Shrinkage strains set up in the babbitt metal liner by the unequal distribution of the babbitt metal over the shell.

2.—A lack of contact between the babbitt metal lines and the cast iron shell.

3.—The lubricant becomes partially deflected into the wrong place.

4.—Oil grooves cut wrong, because instead of helping the lubricants, they generally drain the oil from where it is most needed. Proper lubrication of bearings involves careful consideration of the materials comprising the journal and its bearings.

Bearings in general use are mainly of cast iron steel, various alloys of bronze and babbitt. As lubricant material is intended to prevent contact between the metallic surfaces, it follows that the greater the pressure of the work per sq. in. of bearing surface, the greater the required viscosity.

Mineral oils semi-fluid at 68 degrees Fahr. may lose half their viscosity at 95 or 105 degrees and become quite mobile at between 122 and 140 degrees.

Heavy-bodied syrup-like liquids at low temperatures offer great resistance to fluidity and the displacement of their particles, and are most suited for slow speeds and heavy pressures.

For light-running shafts a mineral oil of suitable viscosity is desirable.

To sum up, the lubricant should possess a sufficient degree of viscosity, so that it is neither squeezed out between the moving surfaces nor wasted by the rapid motion of the running machinery. In other words, the oil should have just sufficient viscosity to keep the moving surfaces apart under the maximum pressure. It should be also free from grit and suspended matter.

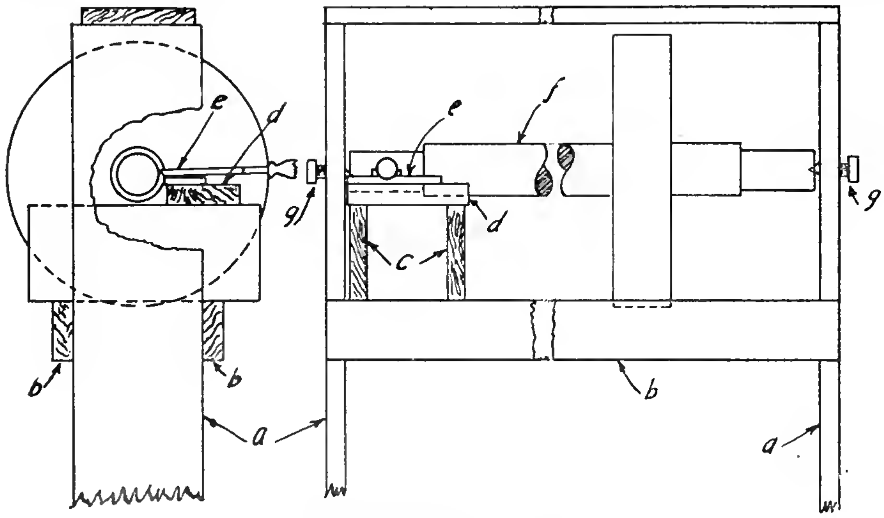
If these conditions are faithfully carried out, many troubles and much expense will be avoided.

A LUMBER LATHE.

By J. McCormack.

THE article entitled an "Ingenious Way Out of a Difficulty," which recently appeared in your columns, brings to mind a similar repair made some time ago in a shop unprovided with suitable equipment.

One of the journals of a six-foot shaft, 2 7-16 ins. in diameter, travelling at a speed of 1,550 r.p.m., had, by hard usage, overloading or lack of proper lubrication become badly worn, and after a time became quite troublesome. Rebabbitting had been tried with very poor results, owing to the scored condition of the shaft. Application of a pair of calipers revealed the fact that the journal was not parallel and also out of round from 1-64 to 1-32 of an inch, due, no doubt, to the uneven density of the metal.



LUMBER LATHE DETAILS.

There being no lathe within a distance of a number of miles and as the expense of transportation would have been considerable, the following "repair-on-the-spot" method was adopted with fairly satisfactory results.

The two planks (a) and (a) which comprise the "headstock" and "tailstock" of the "lathe" were held in a vertical position by the "bed" planks (b) and (b) at a distance slightly greater than the length of the arbor (f). The "saddle" planks (c) and (c) were placed crossways on the bed and supported the "compound rest" (d).

The "tool post" (e) consisted of a piece of flat steel secured to the plank (a), and the "centres" of the "lathe" were a couple of wood-screws (g) and (g).

The turning operation was performed by using an old file ground on the end in the shape of a flat scraper, being allowed to move freely upon the piece of flat steel. By careful handling of the scraper a fairly good job resulted. The arbor was revolved by belting the pulley to a line shaft. In the absence of a power shaft fairly good results might be obtained by revolving the pulley by hand.

When the arbor was replaced, rebabbitted and scraped, better results were obtained than had been the case since the first season of installation. Later a lubricating device was added, after which the bearings gave no further trouble.

TRIBUTE TO OUR FLEET.

THE Archbishop of York, at a Mansion House meeting at York recently, gave his impressions of a visit just paid to the Grand Fleet.

His Grace said: "I am still compelled to speak of that visit with very considerable reticence for obvious reasons, though I hope that the time may come when I may be able to give some record of it. I find it quite impossible to convey any impression of the scenes which I saw or the spirit which I felt, but it is sufficient for me to say that I realized as never before the debt which we here at home owe to these sleepless guards of our island shore. You will realize that these men have been out, not for three minths nor six months, but for twelve months; that during certainly five of these months they suffered hardships which it is difficult for me to describe, spending practically the whole of that time at high speed on wild seas unable to find any secure place of refuge or of protection.

Even now, though happily they are able from time to time to find places of rest, they are all of them living under war conditions, ready to steam out at short notice whenever the challenge comes, under ceaseless strain of manifold difficulties and dangers that we find it very difficult to understand, very near in some cases to their homes, and yet denied the chance even of short leave. There are thousands of men there who, during the whole of these twelve months, have never had a chance of even seeing their wives and children, yet I find there in every part of the fleet, from the Commander-in-Chief downwards, the same spirit of cheerfulness, of readiness, of determination.

It was to me a very great privilege to be allowed to bring to them a message which I hope was real and was sincere, that though our fleet is necessarily out of sight, it is never out of mind. My business was to tell these men that their country was standing by them and was grateful to them, but I am bound to say that having visited them I feel it is more incumbent upon me to bring some word to the people and to ask our fellow-countrymen at home, whether we really are standing by them, whether our sacrifices, our determination, and our unity are in any degree comparable to theirs. All I can say is that if the citizens here at home are filled with the same spirit of devotion, comradeship, and unity as fills our guardians of the fleet, then, humanly speaking, we need have little fear of the result."

EVERY MAN FOR HIMSELF.

THIS condition is the antithesis of co-operation and is present to an undesirable extent all around us. Some go so far that they follow this policy at the expense of others and associates. Others unconsciously follow such a policy to a lesser degree. Co-operation is necessary to secure any degree of efficiency and in the same organization one must, in a sense, make the other fellow's business one's own business also.

The man who neglects co-operation is destructive to organization. In his own eyes only his opinion holds good, he accepts the asistance of associates indifferently, finishes his job just as far as duty requires and passes it on to the next department and stops right there. Other fellows "go out of their way to do a favor." When they go to attend a poor light complaint, they fix the door bell which is out of order, and if, on the way out, the car runs off the track, they get out and help the crew apply the jacks.

These are extremes. Both fellows injure themselves, but the last man's attitude is to be preferred. A common-sense view and application is better. We should always be ready to assist each other in an open, broad-minded manner, not open to the criticism of an attempt to usurp another's duties or authority.

July Fire Loss.—July fire loss in Canada was only $773,269, the lowest by far of any July in several years. The economical and careful spirit engendered in the public mind by the war may have had something to do with the record. The total fire loss for the first half of the year amounts to $8,017,053, of which Ontario suffered $3,279,316.

CONTEMPORARY WAR ARTICLES

Embracing Information and Data Drawn from a Variety of Sources Relative to and Arising from the Prosecution of this Many-Sided European War

MODERN MUNITIONS OF WAR.

IN his second lecture on "Modern Munitions" at the Royal Society of Arts recently, Professor Vivian Lewes discussed shells and high explosives. Before coming to the actual subject matter of his discourse, however, he said there was one point he could not help mentioning. He realized that the Society of Arts was not the place for contentious matters; certainly it was not the right place to discuss political questions and political methods, but there was one factor he could not pass by, and which was that in the management and conduct of the war probably the most serious mistake that had been made had been to omit placing an embargo on cotton, which would prevent it getting into German hands. He had shown in his previous lecture that for every propellant made the world over cotton was an absolute necessity.

Cotton Importation Into Germany.

It was known for a fact that Germany had been collecting and storing cotton in enormous quantities before the war commenced; it was known as a fact that Germany expected to smash through everything and force a decision by last Christmas, and we know as a fact that the delay in doing so had upset to a very considerable extent her arrangements. Therefore, there was not the least doubt that, if cotton had been made contraband at the very commencement of the war, long before this Germany would have been feeling the pinch seriously. Inasmuch as, however, direct importation into Germany only had been stopped, it happened that we found for the first three months of this year the neutral countries such as Holland, Sweden, Denmark and Norway imported exactly six times as much cotton as they did for the first three months of last year.

Thus we had a very shrewd idea of where this surplus cotton went, and before it was too late he sincerely hoped that some diplomatic method might be found for getting out of this trouble. At the same time, it was all very well to say that so-and-so should be done. We knew perfectly well that we had diplomatists at work, in England especially, who could not be surpassed, and there were excellent reasons for what had been done, but we were now at a point when so many lives were depending upon this matter, and when it was an absolute necessity to stop the supply of cotton to Germany, that no diplomatic interference ought to be able to prevent an embargo of the strictest kind being put upon it.

High Explosive Shells.

Professor Lewes then proceeded with his lecture proper. He first described the ordinary shrapnel by the aid of a colored sectional drawing, and explained, as an instance, that a 6-in. shell with its 375 bullets would cover an area of 300 yards in diameter, and that this was the most effective form of shell for use against troops in the ordinary way. There was no question of any shortage of these. The shortage had been in high explosive shells, the need for which had only arisen with the present war. Such shells when they burst produced such an enormous concussion in the air that obstructions and impediments in the way of the troops were swept away. The effects were simply tremendous. By the mere impact of the wave they set up in the air men were killed at very considerable distances without being touched by any fragment of the shell.

High explosive shells of this character were used for siege work and for armour-piercing. In the latter connection a large amount of research had been carried out with the object, on the one hand, of increasing the strength of armour plate, and on the other, of producing a high explosive shell to penetrate that armour. The shell in that case was made, not of forged steel, as in the ordinary high explosive shell, but of nickel-chrome steel.

The lecturer then explained the phenomenon of the soft nose, which was so well illustrated by Sir Robert Hadfield in his lecture before the Institution of Mechanical Engineers last session. The remarkable effect of this soft nose was, he added, discovered, like so many other things, by accident. Whilst experiments were being carried on, a shell was fired at the back of a test piece of armour-plating, which was the soft side of the metal, and it was found that the shell went through and exploded after impact, whereas when the shell was fired against the front of the plate, which was the hardened and tempered side, it shattered and left an indentation of only a few inches in the plate. This led to the adoption of the soft nose, with the result that a shell could be made which would go through the toughest piece of armour plate that could be produced. Of shrapnel and the class of high explosive shell mentioned above there was no shortage whatever. It was only the high explosive shell for field purposes which had given trouble and in which there was a shortage.

Hand Grenades and Bombs.

Before dealing with the nature of the chemicals employed in the manufacture of high explosive shells, Professor Lewes described and exhibited the hand grenades and bombs which have become such a feature of the war. The service pattern rifle grenade is a small shrapnel shell, devised by Hale. Its casing is serrated, and it contains a cartridge of four ounces of trinitrotoluene, which is fired by a detonator. Attached is a vane for directing the flight and operating the detonating mechanism. The firing is effected in ordinary use of the rifle, except that the bullet of the cartridge is extracted and the end filled up with beeswax. The range of such grenades is about 350 yards, and a special sighting arrangement is fixed for use where the grenades have to be dropped upon the enemy and not fired in a straight direction over a short distance.

With the hand grenades the range is naturally considerably shorter, being about 45 or 50 yards, and in order to prevent premature bursting of the shell, arrangements are made for the firing action not to operate until after the grenade has travelled 15 yards. Another form of hand grenade exhibited had a larger number of serrations and exploded by percussion through striking an object.

Nature of High Explosives.

Attention was next directed to the nature of the high explosives actually used. It was demonstrated how all burning depends upon the oxygen in the air, but that this is such a slow process that an explosive mixture could not be made. By taking substances, however, in which it was possible to have oxygen in a compressed form and yet available for burning, a useful explosive could be obtained. Such substances were almost unlimited, and mention was made of chloride of potash and potassic nitrate, both of which contain about 600 times their volume of oxygen, the latter, of course, being used in the old gunpowder. A number of experiments was made to show varying degrees of rapidity of explosion.

Nitro-glycerine was next referred to as one of the very highest explosives, and an explanation was given of why the greatest effect of the explosion is in the downward direction. The lecturer then sketched the production of picric

acid from coal tar derivatives, and pointed out how in 1882 Sprengel, before the Chemical Society, demonstrated that picric acid by itself could be detonated and give a fine explosive result. Nothing more was heard of the matter for two or three years, when Turpin, a French student of explosives—a dentist at the time, by the way—took out a patent for using it as an explosive for filling shells, and it was introduced into the French service under the name of melinite.

Lyddite.

The accounts which reached Britain of the wonderful effects of this new explosive, that it would kill a man at 200 yards without touching him and knock down any fortification, created considerable alarm in the newspapers; but in a couple of weeks our Secret Service knew all about it, and experiments at Woolwich proved it to be an old friend, because several years before Sir Frederick Abel had introduced picric acid as powders. Experiments were then carried out by us at Lydd and a mercuric fulminate detonator used, with the result that this explosive was introduced into this country as lyddite.

It proved, however, a disappointing explosive. In the South African war it was found that on many occasions the explosion took the form of a semi-burning, and this was subsequently traced to the fact that we had not used sufficiently powerful detonators. Later on, the Japanese, in the Russo-Japanese war, used strong mercuric fulminate detonators and shells of the same explosive, which was called by the Japs Shimosi powder, did good work at the siege of Port Arthur. The Japs, however, took risks in doing so and paid the penalty in serious losses of men and material by premature explosions.

Trinitrotoluene.

All this time the Germans were watching with the greatest interest everything that was going on and noticed the weakness of lyddite and the Shimosi, which was that they formed certain compounds leading up to premature explosion. The Germans eventually hit upon trinitrotoluene, a product of the carbonization of coal. The present process of coal carbonization for the purposes of gas manufacture did not give a very large amount of toluene owing to the high temperature in order to give the best results from the gas point of view; but with a lower temperature the amount could be very considerably increased, and there was not the least doubt that if the war lasted very long and larger quantities of toluene were necessary in order to get high explosives, then a lowering of the temperature of coal carbonization in gas works would have to come about.

Toluene was also being made synthetically in considerable quantities by the action of heat and pressure upon other hydro-carbons, and both sources put together would undoubtedly give us very considerable quantities of toluene and as much as we should require for nitration purposes in the future. The lecturer showed various samples of T.N.T. and explained how it is copper-plated to prevent mechanical damage. He also dwelt upon the safety with which it can be handled, and emphasized that the tremendous effects produced follow detonation.

Ammonite.

A stronger explosive than T.N.T., however, was ammonite, which consisted of nitrate of ammonia mixed with 15 per cent. T.N.T., and which was invented in Austria. The advantage was the great economy in T.N.T., and for one branch of the British service we were now making considerable quantities of this explosive.

Still higher explosives, however, were being made, one of which was obtained by using benzol as a basis, and in this way the mining explosives of roburite and bellite were obtained.

Another new explosive about which a good deal more would be heard in future was tetranitro-anyline, which had the advantage over nitro-glycerine, that it was sufficiently inert to be safe in use; and finally there was an even more powerful explosive, viz., tetra-nitro-methyl-anyline, known as T.N.A. This latter had a tremendous concussive effect, and was the cause of men being found dead, but to all outward appearances uninjured. Many cases had occurred in which a displacement of the heart to the extent of nearly 2 in. had been found, and this had been caused simply by the concussive effect of T.N.A., and not by poisonous gases, as was often stated in the newspapers.

All this, concluded Professor Lewes, was part of the horror of war. The mischief from hell's kitchen—poison gases—with which the Germans had disgraced themselves, he would deal with in his next lecture.

SAFETY FEATURE OF HIGH EXPLOSIVES.

IN view of the fact that a great many workmen and perhaps workwomen also in Canada will soon be engaged in loading high explosive shells for the use of the Allies, some recent observations by Hudson Maxim, a famous inventor of explosives, regarding the relative safety of tri-nitro-toluene, which will be used very largely, will be reassuring. He says:

"High explosives had been pretty well perfected before the outbreak of the great war. Nevertheless, we have received reports of some astonishing effects produced by the French turpinite and the Austrian skeds shell. It has been reported that so dreadful is the concussion produced by the detonation of the new high explosive that troops are killed by the mere concussion even to a distance of a hundred yards. Such results are highly improbable, for it is impossible to make a high explosive which will develop more force than results from the volume of gases liberated and raised to a high temperature by the chemical reaction of detonation.

"Picric acid and nitrogelatin come very near to the limits of the possible in power of high explosives. Turpinite is probably picric acid or a picric acid compound, but on account of the scarcity of picric acid at the present time it is probable that the more easily available tri-nitro-toluene is largely used instead. Tri-nitro-toluene, although not so powerful as picric acid or ntiro-gelatin, is yet exceedingly powerful. It is also so insensitive that not only may projectiles charged with it be fired with perfect safety from cannon at high velocity, but also projectiles charged with it may be fired through armor-plate without being exploded by the impact, so that they will pass to the interior of a war vessel to be exploded by a delay-action detonating fuse."

Shell loading is a new business in Canada, and it is comforting to learn that the explosive likely to be most largely used in "fixing" the ammunition can be handled without excessive danger.

The Spelter Outlook.—A large United States producing interest quotes spelter deliveries around the end of the year at 16½ to 17 cents, and spot metal 18 to 18½ cents. The scarcity of spot spelter has been largely overcome by the output of the smelters. Export orders have dropped off, and although exports have been large over recent months, these shipments represent orders placed some time ago.

Strengthened Aluminum. —While aluminum is made more suitable for many mechanical purposes by alloying with 9 to 12 per cent. of cobalt, it is still too coarsely crystalline to be strong, but in remedying this by adding a little tungsten or molybdenum, alloys have been obtained three times the tensile strength of pure aluminum. The best results were obtained with 0.8 to 1.2 per cent. of tungsten and 8 to 10 of cobalt, or 0.6 to 1 per cent. of molybdenum and 9 to 10 of cobalt. Increasing the tungsten or molybdenum and cobalt adds to the tensile strength but makes forging and rolling more difficult, the tungsten alloys being somewhat harder than the molybdenum.

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

SHELL NOSING AND BANDING HYDRAULIC PRESSES.

IN the manufacture of shrapnel and high explosive shells after they have been forged and drawn into shape, two hydraulic pressing operations are necessary—that of nosing the shell and then pressing or shrinking the copper band around it. The Hydraulic Press Manufacturing Co., Mount Gilead, Ohio, are now building hydraulic presses for both of these operations, as well as for the forging and drawing operation, to the order of both United States and Canadian manufacturers who are engaged in the production of these munitions of war.

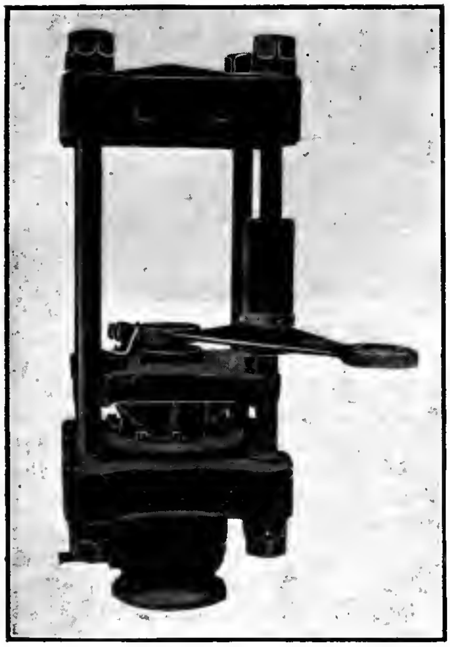


FIG. 1. SHELL NOSING PRESS.

Shell Nosing.

Fig. 1 illustrates an upward pressure type of press which is used for nosing or pointing the shell after it has been formed from the solid steel billet, drawn into shape and later machined. The end of the shell is heated and set in a centering die on the platen of the press. A die, having a conical shape to correspond to the nose of the finished shell, is attached to the head of the press. The shell is then forced into this side and the edges turned in. A two-arm revolving loading attachment wroks upon one strain rod. This revolving attachment has a capacity for receiving two shells, one on each end, thus enabling the operator to have a shell in constant waiting to undergo the nosing operation.

The nosing press is capable of exerting a maximum pressure of 150 tons, and is solidly built, steel being used throughout in its construction. The press is operated either direct from an independent pump or from an accumulator system.

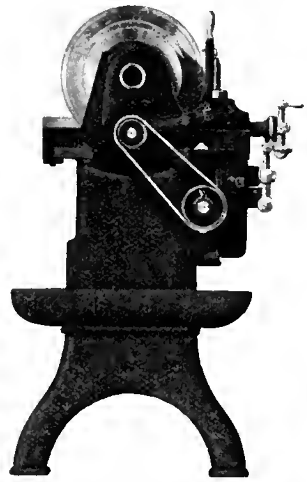
Banding Operation.

After the shell has been pointed, the next pressing operation is that of shrinking the copper band around the base of the shell. For this purpose, the four-cylinder horizontal press, Fig. 2, has been designed. The rams from the four cylinders press in from four directions, thus taking care of four sides of the band at once. To properly secure the band at all points the shell is turned two or three times. From 20 to 75 tons pressure is necessary for the work. During the pressing operation the shell is supported in the centre of the press by an adjustable table or stand from beneath the heads of the rams. The maximum pressure capacity is 75 tons. The press is operated from either an independent pump or from an accumulator system.

NEW MANUFACTURING LATHE.

THE advent of the shell industry has served to impress manufacturers with the economies which can be effected through the use of single purpose machines. The manufacturing lathe is a machine of this type, its work being confined to plain turning of the heaviest kind, complete facilities for rapid and accurate handling of the work being provided.

A recent machine of this type has been put on the market by the Rockford Tool Company, Rockford, Ill., which embodies all the elements of power, accuracy and simplicity. It swings $16\frac{1}{2}$ inches over the bed, has a three step cone with a maximum diameter of 13 inches, and a belt width of 4 inches, enabling ample power to be supplied to the lathe spindle. A two speed friction countershaft makes six speeds available.



END VIEW 16-IN. MANUFACTURING LATHE.

The spindle is made from a crucible steel forging, and runs in Babbitt metal bearings, the Babbitt metal being seated

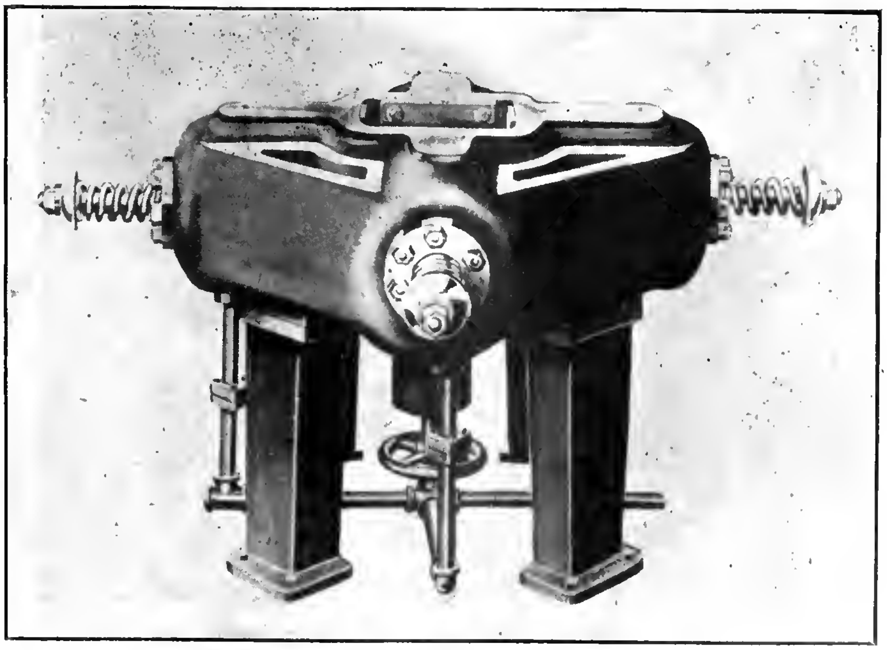


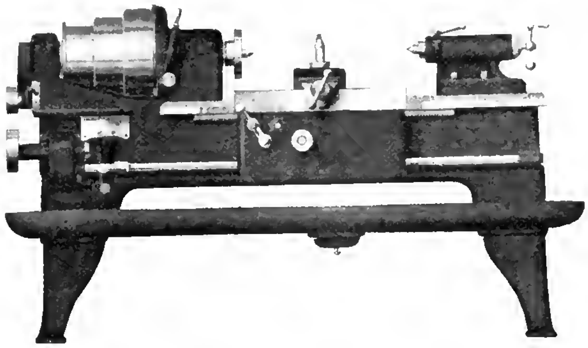
FIG. 2. FOUR CYLINDER BANDING PRESS.

in dovetail slots. The spindle has a front bearing $2\frac{3}{4}$ inches in diameter by $6\frac{1}{4}$ inches long, with provision for ample lubrication. A 1 7-16 inch hole is provided in the spindle. A control lever is installed which operates a powerful friction clutch and applies a brake, while the two speed countershaft allows the work to proceed without interruption due to throwing in back gears, etc.

The bed is deep, well ribbed, and has special wide V's. A 6 ft. bed takes 26 inches between centres. The tailstock is clamped with two heavy bolts and can be set over for turning tapers; the spindle bearing is $2\frac{3}{8}$ inch dia. x 9 inch, long.

A heavy plain rest is supplied, having a slide $7\frac{1}{2}$ inch wide, provided with taper gibs. The cross feed is by hand only, the feed screw having a large diameter dial graduated in thousandths. Four longitudinal feeds are furnished varying from 15 to 105 threads per inch.

The two speed friction countershaft runs at 80 and 225 revs. per min., the pulley being 14 inches dia., for 4 inch belt. A large pan for oil and chips is regularly furnished.



16-INCH MANUFACTURING LATHE.

MAGNETIC BRAKE.

MACHINE shop and mill operators will be interested in the new alternating-current magnetic brake described below. It has been designed especially for use with induction motors, operating cranes, hoists, roller lift bridges, and many different classes of mill machinery, and is applicable wherever frequent stops and reversals are necessary. The operating magnet is single-phase and may, therefore, be used on polyphase circuits.

The action of the brake is simple. When the controller is thrown to the off position, two brake shoes are forced by means of springs against a cast-iron brake wheel which is keyed to the motor shaft. When the motor is started, the magnet coil is energized and the action of the magnet, operating through a lever and a toggle, forces the shoes apart and releases the brake.

In the design of this brake, the Westinghouse Electric Manufacturing Co. have embodied several improvements. It is a complete self-contained unit that can be mounted directly beside the motor or on a special sole plate. Since the application of its braking action is not dependant upon gravity, it can be mounted in any position, from the horizontal to 90 degrees in such a direction that the movable magnet lever has no tendency to fall away from the stationary magnet core. This makes it especially desirable for application where the position of the motor changes during the operation, as on a roller lift-bridge.

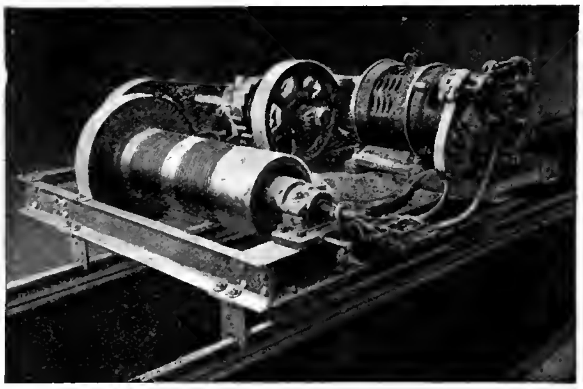


FIG. 2. TYPE "A" BRAKE APPLIED TO CRANE MOTOR.

The overall height has been reduced to a minimum, so that it can be used in places where head room is limited, as, for instance, in crane service. The insulation is such that the brake is adaptable for use outdoors and exposure to the weather without any modification whatever. No dashpots are used, thus all possibility of trouble due to sticking is eliminated. The brake shoes are made of cast-iron to which are fastened woven asbestos fabric linings. The wheel is made of cast-iron, and the coefficient of friction between the brake wheel and shoes is not materially affected by oil, grease or water.

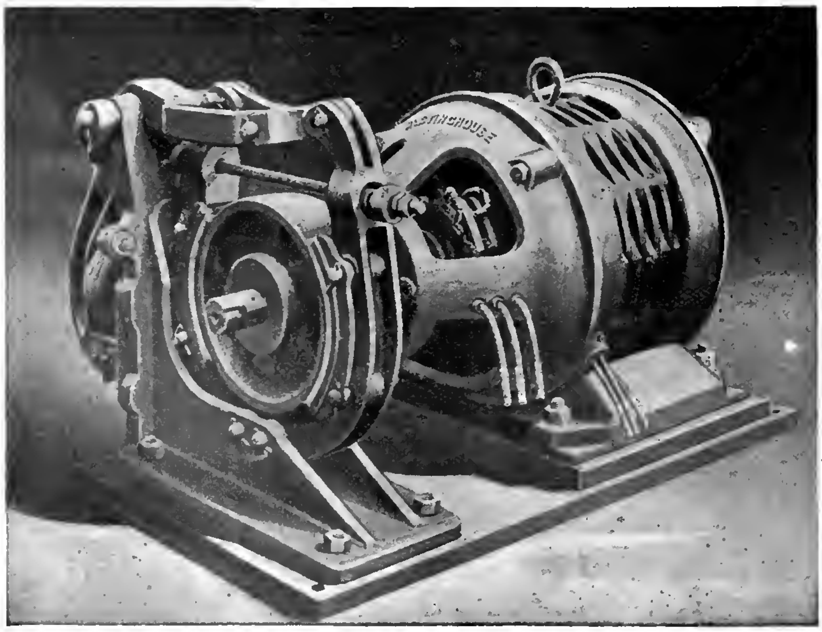


FIG. 1. TYPE "A" BRAKE APPLIED TO POLYPHASE MOTOR MOUNTED ON SOLE-PLATE.

The pressure on the brake shoes can be varied by means of nuts on the spring rods, and wear on the shoes can be taken up by means of an adjusting screw. Two springs are used and only two adjustment points are necessary. If the operator fails to take care of the adjustment which compensates for wear on the shoes, the result will not be a failure of the brake to set, it will only mean that the machine cannot be started, as the brake will not release. With a view to facilitating repairs, axle steel pins held in place by cotter pins have been used wherever possible. A pair of pliers and screwdriver are the only tools necessary, to completely dismantle or assemble the brake.

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CANADA'S DESTINY—AFTER THE WAR, WHAT?

TO every branch of Canadian industry, the war comes home more closely each week. There are few persons in Canada to-day who do not have a relative, friend, or acquaintance on active service in Europe, and there are just as few who are not engaged or interested in the industrial activity which is necessary to maintain our soldiers in the field.

The total value of war orders placed by the British Government with Canadian firms reaches the enormous sum of $230,000,000, and the fact that over 75 per cent. of this has been on account of munitions of war alone serves to show how intimately the present prosperity of our engineering industry is associated with the war.

These figures relate to British contracts only and do not take account of the further huge sums involved in similar contracts with Russia and France. The feverish activity, the numerous extensions to plants, the branching out into various kinds of work by firms which would never have dreamt of such operations in peace time; all these and other conditions, while due to the exigencies of the moment, are having an effect on Canadian industry, which, though likely to be more marked in the immediate future than at a later period, will be none the less permanent and beneficial to the moral and commercial life of the nation.

A leading technical journal in Britain points out one direction in which the ultimate triumph of the Allies will indirectly benefit the world. The Engineer says: "To a quite regrettable and quite unnecessary degree we have for some years relied upon Germany for certain classes of brain and certain kinds of material. If the war had been short we should not have accustomed ourselves to do without these commodities, and in the course of a few years after its conclusion we should have returned to the position of the spring of 1914.............. We must henceforth rely upon ourselves, upon our own British science and inventiveness, upon the genius of our own people. It is said that science is international, that it knows no boundaries or frontiers. That we admit, but, on the other hand, technology, the application of science to industry is distinctly national. It is influenced by a score of things peculiar to the people, and to the country in which they live........"

These sentiments contain the germ idea from which shall develop the conditions and moral standards, on which the destiny of Canada must ultimately rest. Honesty, national and individual is the cornerstone of all permanent greatness. Germany was not honest. The ultimate object of all nations should be to "Live and let live," or rather "Live and help to live." How much importance was attached to this principle of existence by the enemy is evidenced not so much by his conduct of the war as by his actions before, as disclosed by recent events. The glorification of German genius by organized government departments was so successful, the stage managers succeeded so well in monopolizing the centre of the world stage that people began to think there was no nation like to Germany. Facts are now coming to light which show that a highly boosted German inventor was not the genius which the world had been told he was. His original invention was a complete failure, and only the development of his idea by others on totally different lines, and subsequent perfection of it by British engineers saved his name from oblivion.

Careers of this description develop a tendency in Anglo-Saxon nations to belittle the achievements of their own workers, and in manufacturers to decry the efforts of those employed by them. Opportunity is necessary for the development of everything, and the experience of engineering firms in Canada in overcoming the difficulties encountered in producing munitions of war, should remove for all time that prejudice against home genius and products.

Many workers are engaged now on work which hitherto was absolutely strange to them. Manufacturers have had to rely on subordinates to help them out of tight corners which they could never have gotten out of unaided. Draftsmen, toolmakers, machinists, all have had to do things and think things, which in the normal course of events they would never have done. Science, which knows no restraints either in production or distribution, will continue to be international. Technology, the application of science to industry will continue to be national. The Canadian ship of industry has truly found herself, and even now in the hour of national effort, her course is being set so that when the work of recuperation is at hand, her efforts and ability shall not be least internationally.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey Forge, Pittsburgh	.....	$13 95
Lake Superior, charcoal, Chicago	.....	15 75
Ferro Nickel pig iron (Soo)	.....	25 00

	Montreal.	Toronto.
Middlesboro, No. 3	21 00	.....
Carron, special	22 00	.....
Carron, soft	22 00	.....
Cleveland, No. 3	21 00	.....
Clarence, No. 3	21 00	.....
Glengarnock	25 00	.....
Summerlee, No. 1	25 00	.....
Summerlee, No. 3	25 00	.....
Michigan charcoal iron	25 00	.....
Victoria, No. 1	21 00	19 00
Victoria, No. 2X	21 00	19 00
Victoria, No. 2 Plain	21 00	19 00
Hamilton, No. 1	20 00	19 00
Hamilton, No. 2	20 00	19 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	2.20
Steel bars, f.o.b., Toronto	2.20
Common bar iron, f.o.b., Montreal	2.20
Steel bars, f.o.b., Montreal	2.20
Twisted reinforcing bars	2.20
Bessemer rails, heavy, at mill	1,25
Steel bars, Pittsburgh	1.30
Tank plates, Pittsburgh	1.30
Beams and angles, Pittsburgh	1.30
Steel hoops, Pittsburgh	1.40
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.10
Small shapes	2.35
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.90
Structural shapes	1.95
Plates	1.95

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ¼ to ½ in., 100 lb.	$2 35	$2 25
Heads, per 100 lb.	2 55	2 45
Tank plates, 3-16 in.	2 60	2 45

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$11 75	$11 75
Copper, crucible	12 50	12 50
Copper, unch-bled, heavy	12 50	12 50
Copper, wire, unch-bled.	13 50	13.50
No. 1 machine compos'n	11 00	11 00
No. 1 compos'n turnings.	9 00	9 00
No. 1 wrought iron	6 00	6 00
Heavy melting steel	6 50	6 50
No. 1 machin'y cast iron	10 50	10 50
New brass clippings	11 00	11 00
No. 1 brass turnings	9 00	9 00
Heavy lead	4 50	4 75
Tea lead	$3 50	$3 50
Scrap zinc	9 00	9 00

W. I. PIPE DISCOUNTS.

Following are Toronto jobbers' discounts on pipe in effect June 25, 1915:

	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
Standard				
¼, ⅜ in.	63	32½	....	....
½ in.	68	41½	....	....
¾ to 1½ in.	73	46½	....	....
2 in.	73	46½	69	42½
2½ to 4 in.	73	46½	72	45½
4½, 5, 6 in.	....	....	70	43½
7, 8, 10 in.	....	....	67	40½
X Strong P. E.				
¼, ⅜ in.	56	32½	....	....
½ in.	63	39½	....	....
¾ to 1½ in.	67	43½	....	....
2, 2½, 3 in.	68	44½	....	....
2 in.	....	....	63	39½
2½ to 4 in.	....	....	63	42½
4½, 5, 6 in.	....	....	66	42½
7, 8 in.	....	....	59	35½
XX Strong P. E.				
½ to 2 in.	44	20½	....	....
2½ to 6 in.	....	....	43	19½
7 to 8 in.	....	....	40	16½
Genuine Wrot Iron.				
⅜ in.	57	26½	....	....
½ in.	62	35½	....	....
¾ to 1½ in.	67	40½	....	....
2 in.	67	40½	63	36½
2½, 3 in.	67	40½	66	39½
3½, 4 in.	....	....	66	39½
4½, 5, 6 in.	....	....	63	36½
7, 8 in.	....	....	60	33½

Wrought Nipples.	
4 in. and under	77½%
4½ in. and larger	72½%
4 in. and under, running thread.	57½%
Standard Couplings.	
4 in. and under	60%
4½ in. and larger	40%

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65%
Sq. Head Set Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45%
Flat & But. Head Cap Screws	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in. N.	70%
Semi-Fin. Nuts up to 1 in.	70%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

METALS.

	Montreal.	Toronto.
Lake copper, carload	$20 00	$20 00
Electrolytic copper	19 75	19 75
Castings, copper	19 50	19 50
Tin	41 00	40 00
Spelter	22 00	20 00
Lead	6 50	6 50
Antimony	40 00	40 00
Aluminum	40 00	40 00

Prices per 100 lbs.

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh	$22 00
Openhearth billets, Pittsburgh	22 00
Forging billets, Pittsburgh	28 00
Wire rods, Pittsburgh	25 50

NAILS AND SPIKES.

Standard steel wire nails, base	$2 40	$2 35
Cut nails	2 50	2 70
Miscellaneous wire nails	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	75
Stove bolts	80
Plate washers	40
Machine bolts, ⅜ and less	70
Machine bolts, 7-16 and over	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes	4¼c per lb. off
Nuts, Hexagon, all sizes	4¾c per lb. off
Iron rivets	72½ per cent.
Boiler rivets, base, ¾-in. and larger	$3.25
Structural rivets, as above	3.25
Wood screws, flathead, bright	85, 10, 7½, 10 p.c. off
Wood screws, flathead, Brass	75 p.c. off
Wood screws, flathead, Bronze	70 p.c. off

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Standard. Price. per ft.	Extra Strong, Sizes Ins.	Extra Strong, Price per ft.	D. Ex. Strong, Size Ins.	D. Ex. Strong, Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1¼in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.....
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....

COKE AND COAL.

Solvay Foundry Coke	$5.75
Connellsville Foundry Coke	4.85-5.15
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

COLD DRAWN STEEL SHAFTING.

At mill	45%
At warehouse	40%

Discounts off new list. Warehouse price at Montreal and Toronto.

MISCELLANEOUS.

Solder, half-and-half	26.25
Putty, 100-lb. drums	2.70
Red dry lead, 100-lb. kegs, per cwt.	9.67
Glue, French medal, per lb.	0.18
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.18
Benzine, single bbls., per gal.	0.18
Pure turpentine, single bbls.	0.64
Linseed oil, raw, single bbls.	0.65
Linseed oil, boiled, single bbls.	0.68
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Lead wool, per lb.	0.10
Pure Manila rope	0.16
Transmission rope, Manila	0.20
Drilling cables, Manila	0.17
Lard oil, per gal.	0.73
Union thread cutting oil	0.60
Imperial quenching oil	0.35

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto 40%

PROOF COIL CHAIN.

¼ inch	$8.00
5-16 inch	5.35
⅜ inch	4.60
7-16 inch	4.30
½ inch	4.05
9-16 inch	4.05
⅝ inch	3.90
¾ inch	3.85
⅞ inch	3.65
1 inch	3.45

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	60
Carbon over 1½ in.	25
High Speed	40
Blacksmith	60
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Centre	25
Pipe Reamers	80

Discounts off standard list.

IRON PIPE FITTINGS.

Canadian malleable, 35 per cent.; cast iron, 60; standard bushings, 60; headers, 60; flanged unions, 60; malleable bushings, 60; nipples, 75; malleable, lipped unions, 65.

TAPES.

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3.50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$3 00	$2 90
Canada plates, dull, 52 sheets	3 25	3 50
Canada Plates, all bright	4 40	4 60
Apollo brand, 10¾ oz. galvanized	6 40	5 95
Queen's Head, 28 B.W.G.	6 25	6 25
Fleur-de-Lis, 28 B. W. G.	5 75	5 75
Gorbal's Best, No. 28	6 50	6 50
Viking metal, No. 28	6 00	6 00
Colborne Crown, No. 28	5 38	5 30

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$11 00	.....
1¼ in.	11 00	.....
1½ in.	11 00	.....
1¾ in.	11 00	.....
2 in.	11 50	9 20
2¼ in.	13 00	.....
2½ in.	14 00	12 10
3 in.	16 00	12 70
3¼ in.	.....	13 90
3½ in.	20 00	15 00
4 in.	25 50	18 90

Prices per 100 feet, Montreal and Toronto.

WASTE.

WHITE.	Cents per lb.
XXX Extra	0 10¼
X Grand	0 09¾
XLCR	0 09¼
X Empire	0 08½
X Press	0 07¾
COLORED.	
Lion	0 07½
Standard	0 06½
Popular	0 05¾
Keen	0 05¼
WOOL PACKING.	
Arrow	0 16
Axle	0 11
Anvil	0 08
Anchor	0 07
WASHED WIPERS.	
Select White	0 09
Mixed Colored	0 06¼
Dark Colored	0 05¼

This list subject to trade discount for quantity.

BELTING RUBBER.

Standard	50%
Best grades	30%

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50%
Standard	50 & 10%
Cut leather lacing, No. 1	$1.20
Leather in sides	1.10

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	$9.00
¼ in.	6.25
5-16 in.	4.65
⅜ in.	4.00
7-16 in.	4.00
½ in.	4.00

Prices per 100 lbs.

PLATING CHEMICALS.

Acid, boracic	$ .15
Acid, hydrochloric	.05
Acid, hydrofluoric	.06
Acid, Nitric	.10
Acid, sulphuric	.05
Ammonia, aqua	.08
Ammonium carbonate	.15
Ammonium chloride	.11
Ammonium hydrosulphuret	.35
Ammonium sulphate	.07
Arsenic, white	.10
Copper sulphate	.10
Cyanide of potassium (95 to 96%)	.35
Iron perchloride	.20
Lead acetate	.16
Nickel ammonium sulphate	.10
Nickel carbonate	.50
Nickel sulphate	.20
Potassium carbonate	.40
Potassium sulphide	.30
Silver chloride (per oz.)	.65
Silver nitrate (per oz.)	.45
Sodium bisulphite	.10
Sodium carbonate crystals	.04
Sodium cyanide	.35
Sodium hydrate	.04
Sodium hyposulphite (per 100 lbs.)	3.00
Sodium phosphate	.14
Tin chloride	.45
Zinc chloride	.20
Zinc sulphate	.08

Prices Per Lb. Unless Otherwise Stated.

ANODES.

Nickel	.47 to .52
Cobalt	1.75 to 2.00
Copper	.25 to .28
Tin	.45 to .50
Silver	.55 to .60
Zinc	.30 to .33

Prices Per Lb.

PLATING SUPPLIES.

Polishing wheels, felt	1.50 to 1.75
Polishing wheels, bullneck	.80
Emery in kegs	.4½ to .06
Pumice, ground	.05
Emery glue	.15 to .20
Tripoli composition	.04 to .06
Crocus composition	.04 to .06
Emery composition	.05 to .07
Rouge, silver	.25 to .50
Rouge, nickel and brass	.15 to .25

Prices Per Lb.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents

Montreal, Que., August 16, 1915.—The present industrial situation is little changed from that of a week ago, although a slight improvement is noticeable in the steel trade. The shell industry still has quite a call on steel bars for the manufacture of shrapnel and high explosive shells, and the continued improvement in the steel outlook is largely due to the constant demand for material in connection with war contracts generally.

Steel.

Canadian steel mills are now working to capacity to keep up with the demand for steel bars and billets for the filling of war orders and also to take care of further orders which may be placed at any time. If satisfactory conditions prevail in Canada for the completion of finished shells it is more than probable that still larger orders will shortly be placed for varied type shells. Prices remain firm on bars, plates, etc., but a slight reduction is evident on galvanized sheets.

Pig Iron.

Improvement in pig iron is scarcely noticeable although a slight betterment of conditions seems to prevail.

Scrap Metals.

Quotations on the scrap metal market continue firm and little change, if any, falls to be recorded.

Machine Tools and Supplies.

The demand for machine tools has fallen off from that of a few months back, but, although heavy specialties are not so much in request, machine tool supplies show little easing up in demand. High speed steel maintains its abnormally high price and every indication points to its going still higher.

Metals.

Quotations for the various metals are somewhat easier than those of the previous week; slight declines being noticeable in the prices of copper, spelter and lead.

Toronto, Ont., Aug. 17.—An interesting development in the metal industry as a result of the war is the announcement that refining plants for treating copper and zinc will be established at Trail, B.C., and other points. This will help considerably in keeping the cost of these metals on a reasonable basis and also make the trade independent of outside sources. In this connection it is reported that a plant for refining zinc will be established in Welland, Ont. The extent to which Canada is benefiting by war orders is shown in an official statement recently issued by the Department of Trade and Commerce. The British Government alone has placed orders to the value of $230,000,000 with Canadian manufacturers for equipment already made or in process of manufacture. Of this sum $188,183,180 represents the expenditure on munitions. In addition are contracts placed by the other Allies, the particulars of which have not been published but will in the aggregate amount to a considerable sum.

An optimistic spirit prevails in business circles with regard to this season's crop, very favorable reports continue to be sent out from various points in the West and a large yield is expected. On this account the outlook for trade is favorable and in conjunction with the war business, industrial conditions are on a sounder basis than at any time since the war started. The greater part of the trade being done now is for export, the domestic demand being comparatively light although improving.

Steel Market.

War orders continue to keep the mills fully employed and there is every indication of present conditions prevailing for some time to come. The revenue statements of the various iron and steel companies are a good indication of the improvement that has taken place in the trade during the past year. The business is almost entirely for export either directly or indirectly. Domestic business is still dull. The railways have been out of the market for several months, there being very little constructional work in progress. The building trade is showing no indications of improving this year and municipalities are not doing much in the way of buying cast iron or steel pipe. Quotations are holding very firm for domestic products, and prices of bars, plates and shapes have advanced to 1.30c f.o.b. Pittsburgh.

There is little change to note in the galvanized sheet situation. Prices have a weaker tendency due to the continued decline in the spelter market but no changes in sheets have been made locally. Some makers continue to keep out of the market but resumption of regular conditions in the galvanized sheet trade can hardly be expected until spelter is at a considerably lower level than at present when sheets can be made at a price which buyers can afford to pay for ordinary uses.

There is no change in the high speed tool steel situation and considerable difficulty is still being experienced in obtaining supplies of tungsten. Heavy demand and low stocks further complicate the situation. The growing scarcity of chromium is regarded as a factor likely to augment the increasing price of high-speed tool steel.

Conditions in the steel trade in the States continue to improve on account of war orders. The demand for steel bars is extremely active and deliveries are becoming much more extended. Prices are very firm with a higher tendency.

Pig Iron.

The pig iron situation is unchanged. There is a good demand for steel-making pig iron but foundry iron is quiet. Owing to the activity in the steel trade in the States the pig iron market is very firm and some brands have advanced, grey forge being now quoted at $13.95 Pittsburgh. Most of the Canadian mills use their own pig iron so the local market is not affected materially.

Machine Tools.

Considerable activity prevails in the machine tool trade but the situation generally is unchanged. Although no further orders for shells have been placed recently, manufacturers who have received orders for these but have not yet started work on them, are equipping their plants and buying the necessary machinery. The unusually heavy demand for machine tools in the States is making deliveries very slow while Canadian makers of tools are also very busy filling orders. Owing to these conditions there is a brisk demand for second-hand equipment with special tooling fixtures for shell work.

Supplies.

Satisfactory business is reported in machine shop supplies, and prices are generally holding very firm. Brown & Sharpe cutters have advanced 10 per cent. Waste is expected to advance, but no change in prices has been made at present. Half-and-half solder has declined owing to weakness in the tin market, and is now quoted at 26¼c per pound. The linseed oil market is very unsettled, and prices have declined 2c, raw oil being now quoted at 65c and boiled at 68c per gallon. The turpentine market is now quoted at 64c per Imperial gallon.

Scrap Metals.

The scrap metal market is unsettled and weak, with a falling off in demand. Export business has been curtailed on account of the present financial situation and adverse rate of exchange. A number of price changes have to be noted. Cop-

per, No. 1 composition, brass turnings and scrap zinc have all declined, and may go lower still, there being a tendency in that direction. Heavy melting steel is in good demand, and quotations are very firm at the advance. The lead market is weaker, but prices are unchanged. There is little demand for cast iron scrap, and the market is dull and prices unchanged.

Metals.

A general weakness prevails in the metal markets, and further declines in prices have to be noted. Tin, copper, spelter and lead are all lower and show no sign of any immediate reaction. Spelter, while considerably below the high level attained a short time ago, is still too high to be on a commercial basis, and the situation is not greatly changed because of this. The building of new smelters now in progress may help to keep this metal at a more reasonable price. The antimony market is unchanged, and quotations are entirely nominal. There is a good demand for aluminum and supplies are scarce. The market is firm and quotations unchanged. All solders have declined due to weakness in the tin market.

Tin.—The market is still declining in London, and buyers are showing less confidence. Although the tin position is good, the market is being affected by the general depression in the metal trade. Tin has declined 1c, and is being quoted at 40c per pound.

Copper.—The market is unsettled and weak in London, with a corresponding influence in New York. The situation is generally unchanged except that production is increasing, but buyers are showing a lack of confidence, and are more economical in their purchases. The market locally has declined 1c, and lake copper is now being quoted at 20c per pound.

Spelter.—The market is demoralized and continues to decline, not having any support. The decline is affecting brass mill spelter, and not high-grade metal, which is being held at 30c at New York. Local quotations have declined 3c, and are nominal at 20c per pound.

Lead.—The market is dull and weak in London, but the present "Trust" price of 4½c, New York, has put the market in a steady position. Lead has declined ½c, and is being quoted at 6½c per pound.

Antimony.—The market is firm, but buying has fallen off. Quotations are unchanged and nominal at 40c per pound.

Aluminum.—There is a good demand for aluminum, but supplies are scarce. Quotations are firm and unchanged at 40c per pound.

CANADIAN IRON AND STEEL IN 1914.

THE statistics gathered by the American Iron and Steel Institute show that the output of pig iron in Canada in 1914 was 705,972 tons, against 1,015,118 tons in 1913. In 1912 Canada's pig iron production was 912,878 tons and in 1911 it was 824,368 tons. Of the 1914 total, 690,880 tons was coke iron and 15,092 tons charcoal iron. The number of furnaces in blast in Canada at the end of 1914 was 6; the number out of blast, 16. The production of pig iron by grades in 1914 was as follows, comparison being made with 1913:

	1914	1913
Basic	331,456	558,524
Bessemer	184,053	227,662
Foundry	174,346	225,231
All other	16,117	3,701
Total	705,972	1,015,118

Steel Ingots and Castings.

The production of steel ingots and castings in Canada in 1914 was 694,447 tons, of which 675,691 tons was ingots and 18,756 tons castings. The production of open-hearth steel was 549,716 tons, of Bessemer steel 144,447 tons, and of other kinds 284 tons. The total of 694,447 tons includes about 4,800 tons of alloy treated steel ingots and castings, against about 1852 tons in 1913.

Finished Rolled Products.

The production of finished rolled products in Canada in 1914 was 659,519 tons, against 967,097 in 1913. The production of rails last year was 382,344 tons, against 506,709 tons; of structural shapes and wire rods, 59,050 tons, against 68,048 tons; of plates and sheets, nail plate, merchant bars, tie plate bars, etc., 218,125 tons, against 392,340 tons. The production of rolled iron products in 1914 was 47,309 tons, while the production of rolled steel products was 612,210 tons.

Cut and Wire Nails.

The production of iron and steel cut and wire nails in Canada in 1914 is estimated at 1,144,000 kegs, as compared with an estimated production of 1,520,000 kegs in 1913.

PRODUCE AND REFINE ZINC AND COPPER FOR THE ALLIES.

AS A result of arrangements now completed, it has been announced by General Bertram, that Canada will not only manufacture shells for the Allies, but will produce and refine for the first time in this country the zinc and copper required for the ammunition.

These arrangements represent the fruition of the desire and efforts of General Hughes, minister of militia. It was not long after Canada had commenced the manufacture of shells for Great Britain before the securing of copper and zinc for their production became a problem. Although Canada produces both these metals she has not hitherto had facilities for refining them. Consequently every ton of such ore produced in the Dominion had to be sent to the United States, and there refined before being bought back again by Canadians.

United States refiners took advantage of this situation shortly after Canada commenced the manufacture of shells by raising the price of refined copper and zinc to exorbitant levels. It is understood that by forming a combination among some Canadian capitalists and bucking the monopoly General Hughes succeeded in getting the price reduced somewhat. However, it became apparent that if the Dominion were to enter seriously into the manufacture of munitions it must have refineries of its own and efforts toward that end were initiated.

Several conferences have been held between the Shell Committee and the Cabinet. The result is contained in the statement of General Bertram that agreements had been made and were closed up for the refining at Trail, B.C., and other points, of both copper and zinc.

WAR SUPPLIES FROM CANADA.

VERY general interest is being taken by producers and manufacturers as to war supplies provided by Canada, mainly as regards the British Government and, in a lesser degree, as regards the Governments of the Allies. The question as to whether as much is being supplied from Canada as can reasonably be provided is being thoroughly discussed, and assertions vary according to the sources of the information or the strength of the imagination of the parties thereto.

It is comparatively easy to make a statement of what has been supplied by Canada in respect to purchases made by the Allied Governments through direct agency of the Government of Canada. Reliable statistics are available and the information can be fairly accurately given. For the large quantity of materials, directly or indirectly meant for war purposes, which are purchased in Canada outside of direct Government contract, greater difficulty is experienced in coming even at approximate values. The Department is taking steps to get information in regard to this branch of supply, but lack of knowledge of the private parties and corporations that are interested renders the task somewhat difficult.

As to what is being contracted for by the Governments concerned with companies or private dealers, accurate information is possessed by the purchasing

authorities of each Government, but it is difficult for the Canadian Government to possess itself of these from the Governments concerned. As to indirect supplies, there is a large margin with reference to which it seems impossible to get any information.

We publish herewith, says the Weekly Bulletin of the Department of Trade and Commerce, Ottawa, a statement of contracts and purchases made in Canada by the British Government to date. A great deal of what is shown in the table has already been despatched and paid for. A larger part probably is still under contract for delivery according to the conditions of the contract. It will be seen that the detailed value of orders executed or under execution for the British Government in reference to war supplies amounts to about £46,000,000, distributed over a very considerable area.

Purchases in Canada.

Article.	Value.	Remarks.	
Acetone	£ 109,625		
Sulphuric (oleum)	105,500		
Ammunition (small arms)	879,500		
Bayonets	114,583		
Cartridges—			
Complete rounds	......	(200,000 rounds ordered, price not yet fixed)	
4.5 Howitzer	5,497,800		
18 pr. Shrapnel	8,101,200		
18 pr. without fuse	3,325,000		
18 pr. H.E.	2,100,000 5,167,700		
18 pr. H.E. without fuse	2,700,000		
13 pr. H.E. without fuse	......	(100,000 ordered, price not yet fixed)	
Cartridge cases—			
4.5 Howitzer	61,640		
18 pr. Q.F.	80,400		
Cordite—			
No. 8	780,000		
Fuses—			
T. and P. No. 80	2,712,500		
No. 100	750,000	(Estimated)	
Rifles—			
M.L.E. for Mk. VII. / Mk. III. "Ross" Mk. VII.	593,750		
Shells—			
4.5 in. Howitzer empty Lyddite	2,310,000		
60 pr. Lyddite	1,020,000		
18 pr. H.E.	198,438		
18 pr. Shrapnel	863,500		
15 pr. Shrapnel	166,000		
T.N.T.	......	(Orders placed in Canada at $ per lb., but no quantities defined)	
			£37,636,636
Harness—			
Pole draught, 6-horse team	£ 300,000		
Double wheel	394,500		
Head collars	16,000		
Traces	49,218		
Saddlery—			
Complete sets	85,000		
Accoutrements	158,438		
Bandoliers	12,500		
			£1,015,656
Mess tins	13,405		
Water bottles	96,875		
Stock pots (aluminum)	4,500		
			114,780
Sleepers	7,660		
Crossing timbers	416		
Picketing pegs	11,250		
Picketing posts	3,333		
			22,659
Helves (pick-axe)	10,291		
Shovels	7,700		
Miscellaneous tools	......	(Prices not yet stated)	
Field forces	1,717		
			19,708
Ammunition boxes	24,305		
Barbed wire	1,500		
Brushes	9,948		
Candles	4,500		
Matches	8,300		
Nails	943		
Tetanus antitoxin	6,142		
			55,638
			£ 1,228,441
Bags—			
Oat	£ 81,649		
Boot laces	8,840		
Buttons—			
Zinc	2,890		
Clothing—			
Great coats	180,242		
Jackets	521,501		
Trousers	316,200		
Coats—			
Sheep lined	48,271		
Flannel—			
White	27,000		
Hosiery—			
Cap comforters	29,472		
Cardigans	191,770		
Cholera belts	3,640		
Drawers, cotton	40,920		
Drawers, woollen	245,902		
Mitts, woollen	3,059		
Mitts, leather	15,020	approx.	
Socks, worsted	43,392		
Socks, lumbermen's	3,020	approx.	
Socks, long, warm, thick	6,040	approx.	
Undervests	31,117	approx.	
Shirts, flannel	289,413		
Mess tin covers	18,220		
Rubber boots	7,377		
Sheepacks	143		
	£ 2,133,098		
Bacon	£ 639,954		
Cheese	573,879		
Flour	404,103		
Fowl, roast	5,789		
Hay	261,560	Bought through H.C. of Canada.	
	549,276	(4,000 tons weekly weekly for five months, cost only estimated)	
Oats	892,360	Portion bought through H.C. of Canada.	
	780,815	(4,000 tons weekly weekly for five months, cost only estimated)	
Jam	13,372		
Preserved meat	433,687		
Vegetables, dried	124,704		
	£ 4,679,499		
Cables, D. 3	£ 2,655		
Kitchens, travelling	57,250		
Rod, metal	6,523		
Runners	3,750		
Wagons, horse—			
G.S. "Bain"	67,400		
Spares	6,290		
G.S. limbered	41,250		
	£ 185,118		
Summary—			
Munitions	£37,636,636		
Leather goods, timber and misc. stores	1,228,441		
Clothing and textiles	2,133,098		
Food and forage	4,679,499		
Wagons, etc.	185,119		
	£45,862,792		

TENDERS FOR SHEET STEEL AND STEEL BANDS.

THE Hon. Phillipe Roy, Canadian Commissioner General at Paris, has forwarded to the Department communications from the Engineer of Equipment and Traction of the Paris-Lyon-Méditerranée Railway, with reference to the probability of Canadian manufacturers being in a position to tender for 600 tons of sheet steel, classes C, D, and E, for current uses, and 200 tons of sheet steel, classes A and B, for boilers. Net prices are requested per 100 kilos for each of these classes of sheet and by thickness, the prices quoted to mean goods delivered free of all transportation charges, customs duty or other expenses and loaded on cars in a station of the above-mentioned railway system. A table, indicating the maximum simultaneous dimensions (length and width) which the Canadian plant can roll in various thicknesses is also asked for, together with the delays of delivery, which the company would undertake to observe.

The Paris-Lyon-Méditerranée Railway Co. has also the intention of entering into a contract for the supply of 1,500 to 1,800 tons of steel bands, classes B and C, for locomotives, tenders, passenger and freight cars, which it will require during a period of six months. The deliveries of this item are asked to be made according to the needs of the Paris-Lyon-Méditerranée Railway Co. on the dates indicated by them, and according to the special orders, which will be forwarded to the sellers two months in advance and which will indicate the types and number of steel bands to be supplied. Specifications and drawings for these tenders when received, may be inspected at the department by Canadian firms, who may desire to do so. The date originally fixed for the closing of the tenders was July 31, but as the P.L.M. Co. has apparently not received sufficient proposals to meet its requirements, the time will in all probability be extended, in order to allow Canadian firms to compete. Further advices are being awaited from the office of the Canadian Commissioner General at Paris and any additional information will be referred to interested manufacturing companies, after its transmission to the Department of Trade and Commerce, Ottawa. (Refer to File No. 1750).

WAR ORDERS REJECTED.

A CANVASS of leading manufacturers of the United States reveals, says the New York "American," an increasing number who refuse to accept war orders. Those who declare they will not prolong the European war, and the orders aggregating more than $139,100,000 which they have turned away, are as follows:

The Ford Motor Co., $15,000,000.

Ball Engine Co., of Erie, Pa., shrapnel shells, $10,000,000.

The Fischer-Sweeney Bronze Co., of Hoboken, supplies, $1,000,000.

The Essex Novelty Co., of Berkeley Heights, N.J., munitions, $500,000.

The Empire Art Metal Co., of College Point, New York City, shrapnel shells, gun barrels, $1,500,000.

Bosch Magneto Co., New York, electrical devices, aeroplanes, arms and machinery, $12,100,000.

Imperial Metal Manufacturing Co., of Long Island City, shrapnel, $400,000.

Dietrich Bros., Baltimore, $2,000,000.

Excelsior Tool & Machinery Co., of St. Louis, cartridges, $600,000.

Aldrich Manufacturing Co., of Buffalo, 300,000,000 brass shells, $5,000,000.

Eagle Manufacturing Co., Wellsburg, Va., brass shells, $1,000,000.

Driggs-Seabury Ordnance Corporation, Sharon, Pa., arms and big guns, $2,000,000.

Textile Machine Works, Wyomissing, Pa., $500,000.

Burroughs Adding Machine Co., Detroit, $1,000,000.

Republic Metalware Co., Buffalo, N.Y., 2,500,000 cartridges and other orders, $86,000,000.

Bronze Powder Co., of Elizabeth, N.J., powder, $500,000.

Heller Forge Works, East St. Louis, shrapnel casings, unavailable.

United Engineering & Foundry Co., Pittsburg, Pa., ammunition, unavailable.

Commonwealth Steel Co., Granite City, Ill., unavailable.

Herring-Hall-Marvin Safe Co., unavailable.

Colburn Machine Tool Co., Franklin, Pa., unavailable.

Owensboro Wagon Co., Owensboro, Ky., unavailable.

Globe Malleable Iron & Steel Co., Syracuse, unavailable.

Builders' Iron Foundry, Providence, unavailable.

Michigan Copper & Brass Co., Detroit, unavailable.

Cushman Chuck Co., Hartford, Conn., unavailable.

Warner & Swasey Co., Cleveland, unavailable.

National Acme Manufacturing Co., Cleveland, unavailable.

LUMBER TRADE IMPROVES IN NEWFOUNDLAND.

THE lumber export trade from this colony, which has been almost non-existent for the past few years, has been brought into prominence again by conditions growing out of the war. A great demand has developed in Great Britain, not only for pit props for the collieries, but for lumber for general purposes. Lumbering concerns throughout the island, which have been operating entirely for the local trade, have decided to go into the export business on an extended scale.

The export of pit wood alone for the year is estimated at 200,000 tons. A regular fleet of steamers has been engaged for several months in transporting this material from Newfoundland and Eastern Canada, the British collieries having been unable to secure their usual supply from Europe because of the closing of the Baltic Sea and the lumber requirements of the allied armies in France.

During the past 10 years most of the soft wood logs cut in the colony and not needed for local construction have been sent to the pulp mills for use in the large paper-making industry, which has grown up during that period.

BOUNTY TO FOSTER ZINC PRODUCTION.

A SLIDING bounty not exceeding 2 cents per pound, and not payable until the end of the war, has been granted by the Government on Canadian zinc production, with a view of obtaining supplies of this metal for the manufacture of munitions.

A committee of the Government under the chairmanship of the Minister of Finance, after full discussion with members of the Shell Committee, has thus satisfactorily solved the problem of ensuring at reasonable prices a Canadian supply of zinc suitable for use in the production of brass for the making of quick-firing cartridge cases for shells.

Before the outbreak of war, this quality of zinc sold at about eight cents per pound. Since that time the price has steadily risen as high as forty cents and grave fears were entertained that the supply might be entirely cut off. At present, the sources of supply are outside of Canada.

The Shell Committee, representing the British Government in the purchase of shells in Canada, regarded it is absolutely necessary that there should be supplies of this zinc within Canada. Canadian producers were unwilling to go to large expense of installing refineries unless insured against the fall in zinc prices which is inevitable after the close of the war. After considerable negotiation, the Government decided to offer a limited bounty for the production in Canada of zinc, the offer being as follows:—

Bounty Details.

Bounties on a sliding scale, not exceeding two cents per pound, will be granted upon production in Canada from Canadian ores of zinc, containing not more than 2 per cent. impurities, when the standard price of zinc in London, England, falls below £33 per ton of 2,000 pounds, provided that bounties shall not be payable on zinc produced before the expiration of the war or after the 31st day of July, 1917, or on zinc contracted for the Shell Committee at a price of 8 cents or over per pound, total amount of bounty to be paid not to exceed $400,000.

As a result of this action on the part of the Government the Shell Committee, on behalf of the Imperial War Office, has been able to contract for several thousand tons of zinc at very reasonable rates with a further reduced rate for further deliveries.

It will be observed that the object of the bounty is to insure the producers against too great a fall in price in the period between the end of the war and the 31st July, 1917. The bounty will give an impetus to the refinement of zinc in Canada and serve the purpose of ensuring a certain supply of brass to the Shell Committee.

ALLIES' PURCHASING AGENTS.

The Trade and Commerce Department, Ottawa, has published the following list of purchasing agents for military purposes for the allied Governments:—

International Purchasing Commission, India House, Kingsway, London, Eng.

French.—Hudson Bay Co., 56 McGill Street, Montreal; Captain Lafoulloux, Hotel Brevort, New York; Direction de l'Intendance Ministere de la Guerre, Bordeaux, France; M. De la Chaume, 28 Broadway, Westminster, London.

Russian.—Messrs. S. Ruperti and Alexsieff, care Military Attache, Russian Embassy, Washington, D.C.

ORDERS FROM FRANCE COMING TO CANADA.

IT is reported from London that Canadian munitions manufacturers may look forward to receiving substantial orders from the French Government in the near future. For the past two or three weeks representatives of various Canadian groups have been conferring with the French war authorities, with the result that a well-known general, who is recognied as an expert in all that relates to heavy ordnance, has been deputed to proceed to the Dominion to go into the whole question of supplies on the spot. As already pointed out, the French Government were favorable to setting up an additional plant for the manufacture of munitions on French soil rather than to buying outside of France, but as the outcome of last week's conferences this policy was abandoned for financial reasons.

Chambers, Ltd., 80 Don Esplanade, Toronto, are building an extension to their factory and will instal a sherardizing furnace.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Oshawa, Ont.—It is reported that a syndicate propose installing a steel plant here.

Kincardine, Ont.—Fire in the pattern shop of the Hunter Bridge & Boiler Co. works here did about $15,000 damage.

Petrolea, Ont.—The pumping outfit on King Street, owned by the J. & J. Kerr Co., was destroyed by fire on August 16.

Toronto, Ont.—The Chevrolet Motor Co., of New York, have purchased the plant and premises of the Dominion Carriage Co., and will install equipment for making motor cars.

Welland, Ont.—The Canadian Zinc Co., recently incorporated with a capital of $500,000 will build a smelter here. The Quality Beds factory has been leased, with an option of purchase. C. H. Massey, of Sherbrooke, Que., is interested in the enterprise.

Niagara Falls, Ont.—The Standard Smelting and Refining Co., of North Bay is extending its business by establishing a plant just up the Niagara river from Chippewa, where it has secured the mills of the British-Canadian Smelting Co. A large building some 80 feet long, is now being erected, with others to follow.

Vancouver, B.C.—It is reported that the establishment of a steel rolling mill has been arranged between an eastern Canadian firm and Port Moody city council. Details have been discussed between representatives of the firm and the mayor and council, and will be embodied in a formal agreement. The firm has secured 35 acres at the head of the Inlet and the council have agreed to guarantee $100,000 on adequate security.

Municipal

Grimsby, Ont.—The town contemplate installing a waterworks system at a cost of $5,600.

Chatham, Ont.—The Water Commissioners are considering installing hydro power at the pumping station.

Toronto, Ont.—Works Commissioner Harris has reported against the city establishing car shops which would cost $285,000.

Listowel, Ont.—A by-law is to be submitted on Aug. 21, to authorize the installation of a waterworks system to cost $5,400.

St. Thomas, Ont.—City engineer Ferguson has prepared a plan for a city storm sewer system. The estimated cost is $52,230 including excavation, pipe, manholes and catch basins.

Ottawa, Ont.—The by-laws have passed to raise $100,000 to provide for the cost of the construction of an abattoir and $50,000 to provide for the cost of an additional incinerator.

Rodney, Ont.—The by-law to loan the Rodney Woodenware Co., $5,000 to rebuild their factory was defeated. The by-law to purchase the franchise of the Rodney Gas & Water Co., was also defeated.

CANADIAN GOVERNMENT PURCHASING COMMISSION.

The following gentlemen constitute the Commission appointed to make all purchases under the Dominion $100,000,000 war appropriation:—George Gault, Winnipeg; Henry Laporte, Montreal; A. E. Kemp, Toronto. Thomas Hilliard is secretary, and the commission headquarters are at Ottawa.

Matheson, Ont.—The town council are considering the construction of a pipe line to White Fish Lake to increase the water supply. A by-law has been passed to sanction an expenditure of $20,000 on the scheme. McAustin and Anderson, of North Bay, Ont., are the engineers.

General Industrial

Calgary, Alta.—The Southern Alberta Refineries, Ltd., will instal an oil refining plant.

St. Thomas, Ont.—Mr. Fitzpatrick, of Belmont, near here will rebuild his factory which was destroyed by fire.

Saskatoon, Sask.—It is announced that an important canning company in Ontario propose establishing a plant here for canning peas.

St. Thomas, Ont.—The plant of the St. Thomas Packing Co., took fire on Aug. 10, and was considerably damaged. The cold storage equipment was not injured.

Ingersoll, Ont.—John Hayman & Sons, of London Ont., are the contractors for the $30,000 addition to the factory which the Borden Milk Co., will build here.

Collingwood, Ont.—Lacking twenty-eight votes to make up the required two-thirds majority, the by-law to loan the Bryan Manufacturing Co. $20,000 without interest was defeated on Aug. 11, the vote standing: For 520, against, 302. The company in addition to rebuilding its planing mill intended to erect a factory for the manufacture of woodenware.

Building Notes

Toronto, Ont.—A public library will be built at Kew Beach, to cost $20,000. Eden Smith & Sons, Toronto, are the architects.

Sherbrooke, Que.—The tender submitted by the Loomis Deakin Co. for a new city hall has been recommended for acceptance at $7,400.

Windsor, Ont.—Announcement is made here that contracts have been let and work will shortly be commenced on a new $200,000 building for the Merchants Bank. The site chosen is at Oulette avenue and Chatham street.

Montreal, Que.—A syndicate of Boston, New York and Chicago capitalists have purchased a site here and propose erecting a ten-storey hotel, to cost one million dollars. The Corner Realties Syndicate of Montreal are interested.

St. Thomas, Ont.—A building permit has been issued for the construction of the new Huron and Erie office building. The structure will be two storeys high, 30 feet by 60 feet, and will cost $15,000. Excavation was commenced a few days ago.

Regina, Sask.—The Robert Simpson Co., of Toronto, Ont., have awarded the general contract for their new distributing warehouse to Wells Bros., of Chicago, Ill. The building is to be of reinforced concrete, eight stories high, 250 by 100 feet.

Port Hope, Ont.—The Port Hope Hospital, Trust has awarded the contract for the new hospital to W. J. Trick

Some Reasons for Locomotive Piston Ring Failures

By "Melter"

The writer discusses from a practical standpoint, the various factors which affect the life and service of locomotive piston rings. It is evident from the article that the entire responsibility cannot always be attributed to any one cause—either making or using. By the application of proper care in manufacture, and reasonable attention in service, the life of piston rings may be considerably prolonged, and efficiency in service greatly increased.

FROM time to time much has been written concerning various causes of piston ring failures in locomotives using superheated steam, some failures being due to one cause and some to another. Most cases of failure, however, are due rather to a combination of circumstances than to any one in particular.

Classification of Causes.

Causes of breakage, excessive wear, and loss of spring in piston rings may be divided into two main classes, viz.:

A.—Manufacture; consisting of (a) material and (b) workmanship.

B.—Service; consisting of (a), class of engine, i.e., passenger non-drifting, or freight drifting; (b), lubrication, and (c), superheat.

Proper Material Necessary.

Regarding Class A, the selection of suitable material is all important, no subsequent care in manufacture or service being able to prevent the development of defects due to improper composition. The American Foundryman's Association recommends the following analysis:

	Per Cent.
Silicon	1.50 to 2.00
Sulphur, under	.08
Phosphorus	0.30 to 0.50
Manganese	0.40 to 0.60
Total carbon	low.

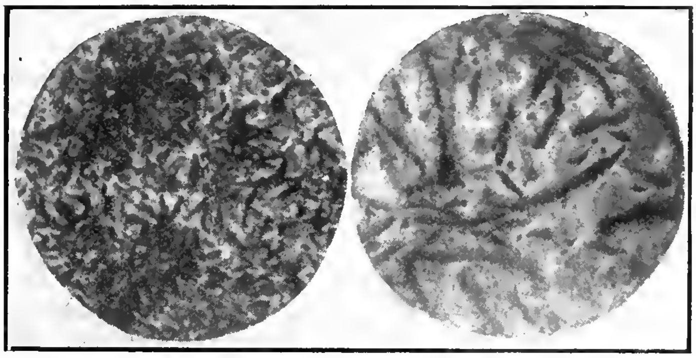
As far as general results are concerned, any close-grained iron comparatively free from oxides will do, but the best results can only be obtained from close-grained rings with the following composition:

	Per Cent.
Silicon from	1.20 to 1.30
Sulphur under	.08
Phosphorus under	.45
Manganese	.40
Graphitic carbon	2.30
Combined carbon	0.70
Total carbon	3.00

This analysis makes a satisfactory ring so long as the combined carbon does not exceed .80 per cent., otherwise the rings will be rather brittle and have a tendency to lose their spring or break. Samples of this mixture when etched with nitric acid should show a structure similar to A, Fig. 1. The dark portions indicating the graphite are small, close together and evenly distributed. The specimen shown at B, Fig. 1, shows the graphite in large bodies, widely separated and unevenly distributed. The comparative suitability of these two specimens is readily apparent to even the untrained eye.

Composition and Cost.

Some concerns use an air furnace to produce their piston ring iron and a good mixture is 33 per cent. pig iron, 10 per cent. steel and 57 per cent. selected scrap. Additions of ferro-manganese, which is used as a deoxidizer, say, 3 lbs. of 80 per cent. alloy to 1,100 lbs. of metal, may be put in the ladle to give greatest efficiency. A test bar from this mixture 1¼ in. diameter, cast vertically in dry sand and tested transversely on 12-inch centres, will give a load of about 3,800 lbs., and a deflection of 38 ins. The tensile strength would be about 29,000 to 32,000 lbs. per square inch, while the cost based on pig at $19.50 per ton, scrap at $17.50 per ton, ferro-manganese at $53.50 per ton, with low sulphur, and coal at $5, would be roughly about 1½c per lb.



A. CLOSE EVEN GRAIN. FIG. 1. B. OPEN IRREGULAR GRAIN.

Making this iron in a railway foundry, where perhaps 50 tons of iron are melted per day in a 90-inch shell lined to, say, 72 in., is not a very easy matter, as it is difficult to produce a structure, or the analysis that is necessary for good service, but a fair iron may be produced by using 30 pig, 20 per cent. steel boiler plate, rails or spring steel (this is to reduce the total carbon and close the grain) and 50 per cent. cast scrap. The method of working out the analysis is shown in Fig. 2. Mixtures are given for air furnace and cupola iron.

Having obtained suitable material, the

Mixture for Air Furnace.

Mixture.	Charge lbs.	%	% Silicon	Silicon lbs.	% Mangan.	Mangan. lbs.	% Sulphur	Sulphur lbs.	% Phosp.	Phosp. lbs.
Pig iron ...	4,000	33.33	2.00	80.00	0.50	20.00	0.02	0.80	0.20	8.00
Scrap	8,000	66.66	1.75	140.00	0.40	32.00	0.12	9.60	0.60	48.00
Ferro Mang.	20	.....	....	.....	80.00	16.00	....	....	....	....
	12,000	100.00	....	220.00	....	68.00	....	10.40	....	56.00
Gross percentage					1.83		0.56	0.08		0.46
Estimated loss by oxidization					20%		30%	0.01 gain from fuel		....
Estimated net percentage					1.47		0.39	0.09		0.46
Net percentage analysis					1.30		0.42	0.078		0.42

By analysis—

Graphite carbon	2.44
Combined carbon	0.72
Total carbon	3.16

Mixture for Cupola.

Mixture.	Charge lbs.	%	% Silicon	Silicon lbs.	% Mangan.	Mangan. lbs.	% Sulphur	Sulphur lbs.	% Phosp.	Phosp. lbs.
Pig iron ...	1,500	30.00	2.25	33.75	0.50	7.50	0.02	0.30	0.18	2.70
Steel scrap..	1,000	20.00	0.02	0.20	0.40	4.00	0.04	0.40	0.04	0.40
Cast scrap..	2,500	50.00	1.75	43.75	0.40	10.00	0.12	3.00	0.60	15.00
Ferro Mang..	10	.....	....	.....	80.00	8.00	....	....	....	....
	5,000	100.00	....	77.70	....	29.50	....	3.70	....	18.10
Gross percentage					1.55		0.59	0.074		0.360
Estimated loss by oxidization					20%		30%	0.03 gain from fuel		.....
Estimated net percentage					1.24		0.41	0.104		0.360
Net percentage analysis					1.18		0.39	0.098		0.430

Graphitic carbon	2.80
Combined carbon	.72
Total carbon	3.52

FIG. 2. METHOD OF WORKING OUT ANALYSIS ON AIR FURNACE AND CUPOLA MIXTURES.

question of workmanship arises, as different methods of making the rings have a greater or less influence on the ultimate efficiency. The influence of workmanship commences right in the foundry, and begins with the manner of casting. Some makers cast their rings in the form of a tub or large pipe and cut them off with gang tools on a vertical turret

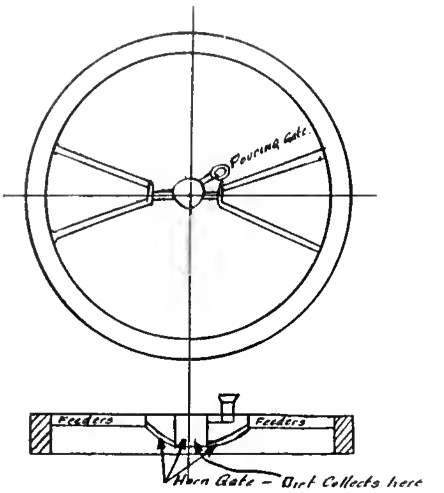


FIG. 3. ARRANGEMENT OF HORN GATE.

lathe or boring machine, while others increase the silicon content so that the rings may be cast singly and still not be too hard to machine. It might be well to state that iron with 1.30 per cent. of silicon is chilled when cast in single rings in a green sand mould, but if the percentage of silicon be increased to 1.60, and the total carbon slightly increased, a good ring will be obtained with correctly tempered sand. It is also best to use a metal pattern. In casting singly, a horn gate is used, as shown in sketch Fig. 3, which collects all the dirt accumulated during pouring.

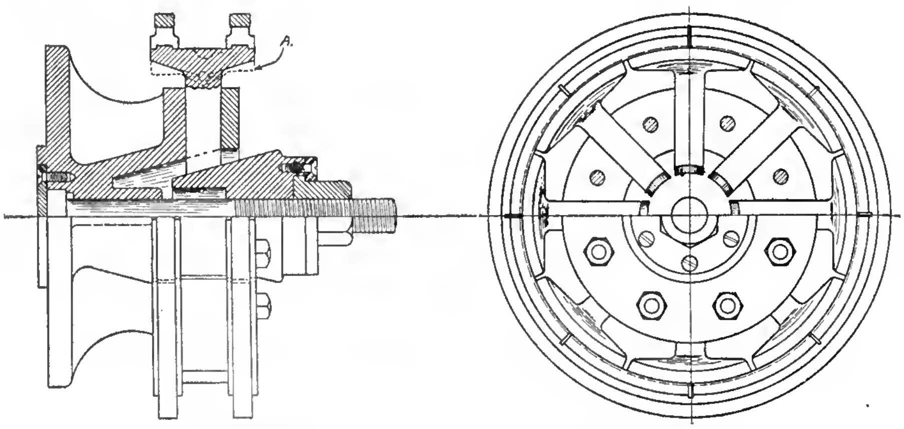


FIG. 4. IMPROVED DESIGN OF EXPANDING CHUCK.

The object in casting single rings is to obtain a denser and harder iron due to the chilling effect of the sand, and the small body of metal compared with a tub and lastly to reduce to a minimum the amount of metal to be machined off, so that the most benefit can be obtained from the superior state of the metal.

Machining.

In machining piston rings which are cast singly, an expanding chuck, Fig. 4, is used with a small modified turret tool holder, mounted on the tool slide, and using $\frac{3}{8}$-inch square tool steel. Only three movements are necessary, a roughing and finishing cut on the sides and a roughing and finishing cut on the face in one movement of the carriage. Gauges are generally furnished, thus securing accurate machining.

The casting is made broad enough so that the edges extend $\frac{1}{8}$ inch over each side of the mandrel, and previous to sending to the machine shop, each casting is thrown into the rumbler barrel and rumbled to remove the sand, after which all burrs or irregularities on the inside of the ring in particular are ground off by the foundry chipping room. The ring next the face plate is slipped on first and placed in position by eye, then the other ring is put in place and the nut tightened. The comparatively large travel of the wedge permits the rings to slip over the mandrels with ease.

The chuck shown in the sketch has been slightly improved as regards practical operation and first cost. Originally there were eight extra pieces, as shown dotted at (A), this piece swivelling on a little roller and the eight sections of the mandrel being held in place by a spring. The present method has proved more satisfactory.

The increased cost of the foundry practice (10 cents per ring, in the case of the single cast ring, as against 40 cents per tub making ten rings), in the one case is counter-balanced by the decreased cost of machining, and in the other case vice versa, whereas in the case of the single ring we have better material. In both instances a ring costs about 40 cents for labor.

Service.

The question of punctuality being of prime importance in passenger service, the opportunities for "drifting" on down grades cannot be taken advantage of to the same extent as with freight engines, where economy has to be maintained. Ordinarily, cylinders receive no oil when the engine is drifting, as the

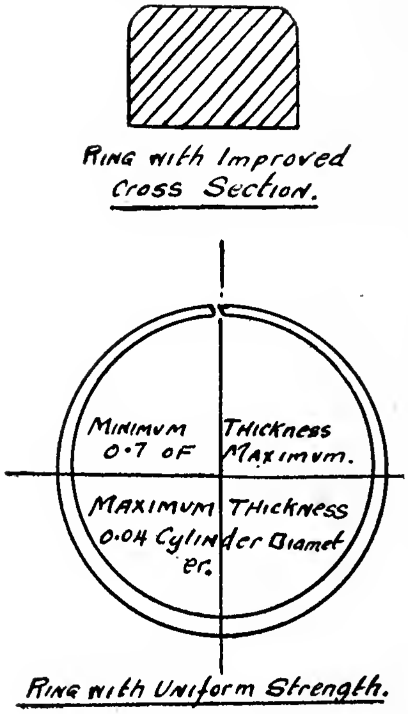


FIG. 5.

supply of oil is controlled by the steam pressure, consequently it is left to the engineer to "crack the throttle" on a down grade so as to maintain sufficient oil supply to the cylinder.

The methods of supplying oil to the cylinders vary. In some engines the oil is admitted to the steam pipes just previous to entering the valve, in others to the live steam valve passages themselves and in a few cases to the cylinders direct, at a point in the middle of the stroke and as near the top as possible. Some of the methods in use are:

(a)—One feed per steam chest, admitting the oil into the steam channel near the steam chest.

(b)—One feed per steam chest, admitting oil into the centre of the steam chamber.

(c)—Two feeds per steam chest, one near each admission point.

(d)—Three feeds per steam chest, one in the centre of the steam chamber, and one at each end near the admission ports, each point of delivery having an individual lubricator feed.

Methods of Lubrication.

The correct way would be directly to the top of the cylinders, as it has been found in three cases out of five that the most wear occurs at this point. It is all

the more necessary to select the best method of lubrication, because the quality and quantity of oil supplied to railroad engineers is standardized and strictly limited to a minimum allowance, according to the type of engine and class of work.

In the case of an engine having cylinders 21 inches diameter by 28 inches stroke, with driving wheels 75 inches diameter, travelling at an average speed of 50 miles per hour, the allowance might be, say, one pint of oil for every 75 miles. The foregoing dimensions and speed figure out at a piston travel of fully 1,000 feet per minute, so that unless all factors which influence the life of a piston ring are properly taken care of, the life of the piston ring may easily be shortened to an unsatisfactory minimum.

The amount of wear in rings varies from .06 inch to .19 inch for 10,000 to 80,000 miles, and the greatest wear occurrs opposite the split. Just what effect an eccentric ring, having uniform expansive pressure, would have on this wear has not been determined, as the other variables have been too great, but there is no doubt the wear would be much more uniform.

Effect of Superheat.

The effect of the high temperature of superheated steam is to weaken the cast iron, causing the rings to lose their spring. Experiments have shown that a superheat of 119 deg. F. is sufficient to decrease the strength 9 per cent., and when steel is heated to a maximum temperature of 400 to 650 deg. F. and stressed sufficient to create 1 per cent. distortion, its brittleness is increased about 33 per cent. Now, if we use a cast iron possessing characteristics somewhat resembling those of steel, which is stronger and therefore less liable to failure, are we not making an improvement in our piston rings?

The grade of oil used is necessarily important and with the moderate superheat used in this country, should show the following characteristics:

Flash point, 560 deg. F.

Burning point, 630 deg. F.

Cold test, 39 deg. F.

Spec. grav. at 60 deg. F., 25 degrees.

Saponifiable fats, 9.0.

Viscosity at 212 deg. F., 205 units.

With different degrees of superheat different oils must be used, i.e., for higher superheat, oil with a higher flash and burning point is required. A high superheat oil may be used for moderate and low superheat, but the cost would be a factor.

If the oil carbonizes, there is an excess of incrustation, which is equivalent to grit, as it causes abrasion. Then again, some tests have shown that excessive incrustation interferes with the ring springing up tight to the cylinder walls, and admits of a leakage of, some say, as much as 200 to 300 lbs. of water per hour.

Practical Points.

Some companies claim that they are getting their rings more uniformly lubricated by altering the section of the ring, as in sketch, Fig. 5, thus cutting off all sharp corners and allowing the oil to get under the ring instead of being scraped off ahead of the piston.

The best practice shows that the bushing must not vary out of round more than 1-16 inch, and the piston diameter must not vary more than ⅛ inch from the cylinder diameter. After the piston ring grooves in piston head have been worn 1-16 inch, a different sized ring is put in and, as the groove increases in size, the rings are increased by 1-16 in., until the original size has been exceeded by 3-16 inch, then the piston is scrapped.

Recently some engines were giving trouble with their rings making only about 300 miles before they had to be renewed. The pistons were changed and the rings made their average mileage.

NOBLEMAN MUNITIONS' WORKER.

SLOWLY, but surely, Britain is coming to realize that she must exert every ounce of her strength if she hopes to win out decisively over Prussian military preparedness. The formation of the coalition war cabinet, with David Lloyd George as war munition secretary, charged with providing the forces at the front with the necessary equipment in required quality and quantity, has brought about a new spirit, and the Britishers are beginning to see that not only the soldiers on the firing line, but the whole nation must work and work hard. The picture shows Lord Norbury, one of England's wealthiest noblemen, who has taken a job in an aeroplane factory as a fitter, both to do his share and by his example encourage others to go to work to do their share. Lord Norbury earns 7d (14 cents) per hour, and is here shown ringing in on an "International" time recorder in his suit of overalls.

LORD NORBURY AS A MUNITION'S WORKER "RINGING-IN" ON AN INTERNATIONAL TIME RECORDER.

Principles of Laying—Off Cylindrical Intersections--IV.

By J. W. Ross

The more or less special nature of the work involved in the making of sheet metal piping has caused many manufacturers to avoid this class of work, with the result that when a job has to be handled, there is frequently considerable unnecessary loss incurred through errors in laying off material. The examples treated by the writer of this article should form a valuable reference to many manufacturers on ordinary as well as special occasions.

CYLINDER INTERSECTION ON THE SIDE OF A LARGER CYLINDER.

THE two elevation views Figs. 29 and 30, and the perspective Fig. 28, shows a small pipe intersecting a larger one. The small pipe being placed on the side of the large one, in a manner so that one side of the small cylinder is tangent to the larger cylinder, while the other side intersects the cylinder. The axis or centre lines intersect each other in both views thus giving the true length of all lines parallel to each view.

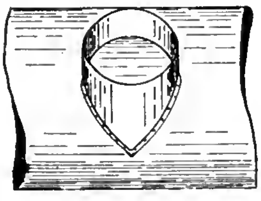


FIG. 28.

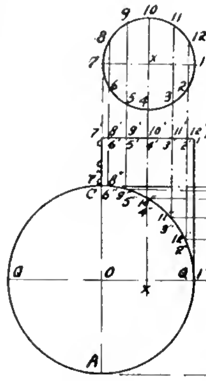


FIG. 29.

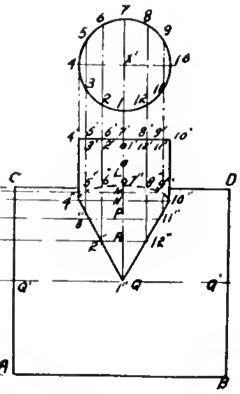


FIG. 30.

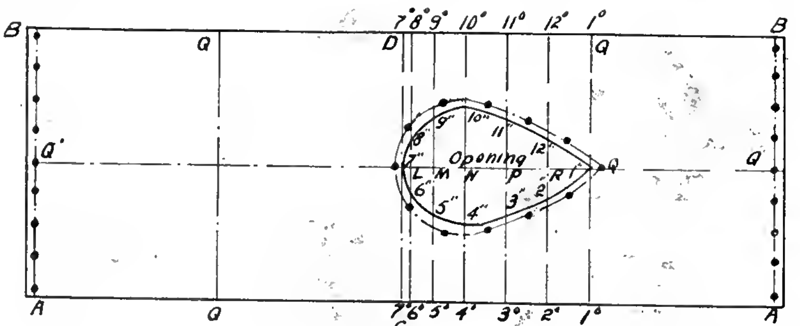


FIG. 32.

Construction.

With centre O and radius O A equal to 2 inches draw the neutral end view A Q C Q. Draw the horizontal line Q O Q. Bisect O Q at X. Raise the vertical axis or centre line X 10 at right angles to Q O Q. Parallel to this line draw the line 1^2 1^1 tangent to the circle A Q C Q. Also draw the parallel line 7^2 7^1 intersecting the circle at C^1. Measure off 7^2 7^1 equal to ½ inch and 1^2 1^1 equal to 1½ inches. Connect 7^1 to 1^1. This line is parallel to the line Q O Q. By this construction 7^1 1^2 equals 1 inch, of which 10^1 is the centre. Draw the plan view of the vertical cylinder, represented by the circle 1, 4, 7, 10. Divide into 12 equal spaces. Project these points down to the intersection of curve C Q. Project the horizontal Q O Q Fig. 29 over to Q^1 Q^1 Fig. 30. Make Q^1 Q^2 equal to 2¼ inches. Build up the elevation view A C D B around the line Q^1 Q^1. Bisect Q^1 Q^1 at Q. Erect the perpendicular Q 7. Project 7^1 1^1, Fig. 29, over to $4^1 10^1$, Fig. 30. Measure off 4^1, 7^1, 10^1, Fig. 30 equal to 7^1, 10^1, 1^1, Fig. 29. Draw the circle 1 4 7 10, Fig. 30, with Y^1 as centre and radius equal to half the neutral diameter of the vertical pipe. Divide into 12 equal spaces, number, and project these points down beyond C D. Draw horizontal projectors from Fig. 29 to the intersection of similar numbered vertical projectors in Fig. 30. Number these points in relation to the intersections. Connect these points, thus defining the mitre line as is shown in Fig. 30, by the points 1^2 2^2 3^2 4^2 5^2 6^2 7^2, etc. Locate the points L M N P Q R at the intersection of the horizontal lines with the centre line 7 Q. Fig. 30.

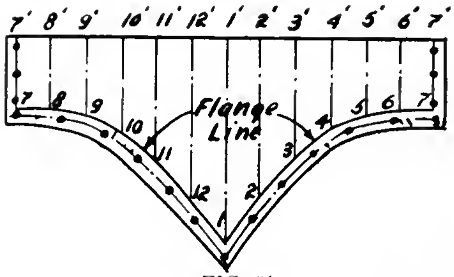


FIG. 31.

The Development of the Vertical Cylinder.

Measure off the stretchout 7^1 1^1 7^1, Fig. 31. Divide into 12 equal spaces. Project these points downwards. Number in relation to the position of the vertical seam. Transfer the element distances from either Figs. 29 or 30. An even

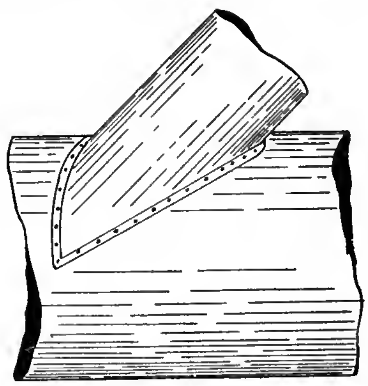


FIG. 33.

*Note: The reference letters and numerals in the text, i.e., G^2, 7^2, etc., correspond with those of the illustrations indicated as G", 7", etc.

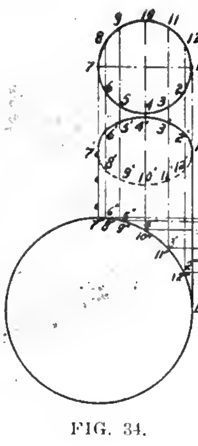


FIG. 34.

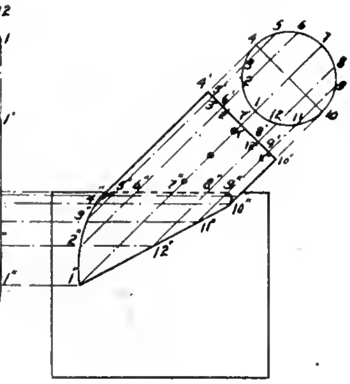


FIG. 35.

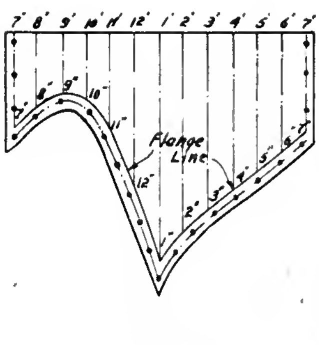


FIG. 36.

curve drawn through these points will define the flange line. Add the laps and draw in the rivet centres. Fig. 31 shows the complete templet.

Horizontal Cylinder Development.

Measure the stretchout, A C A, Fig. 32, equal to 3.14 times the diameter Q O Q, Fig. 29. Bisect A C A at C, erect the perpendicular C D. Take the length of the divisions—along the curve—7² 6¹ 6² 5² 5² 4², etc., Fig. 29. Transfer to 7° 6° 6° 5° 5° 4°, etc., Fig. 32. Raise perpendiculars. Bisect B A at the point Q. Draw the centre line Q Q. Locate the points L M N P Q R, Fig. 32, in relation to their positions in Fig. 30. Transfer from Fig. 30 the distances L 6², L 8², M 5², M 9², N 4² N 10², etc., to Fig. 32, as L 6², L 8², M 5², M 9², etc. A line drawn taking in all these points will define the opening of this cylinder. Draw in the rivet line. Add the laps to the seams B A. Fig. 32 shows the complete templet.

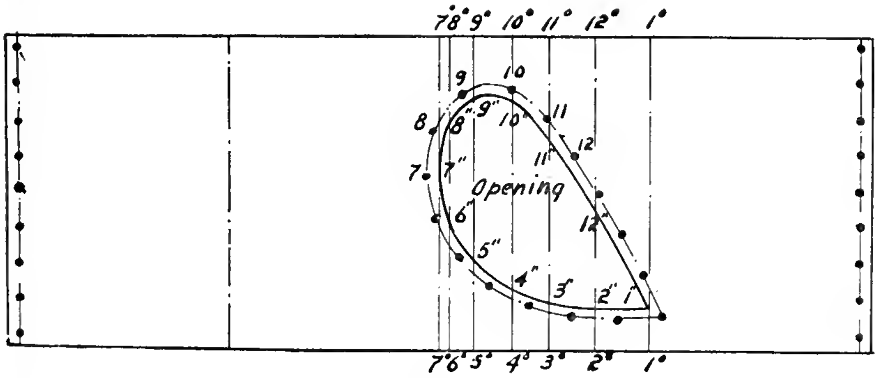


FIG. 37.

Inclined Intersection of 45 Degrees.

The perspective, Fig. 33, and the elevations, Figs. 34 and 35, show a similar problem to the preceding one. The difference being that in one of the views the pipe is inclined to 45 degrees to the horizontal pipe.

From the experience derived from the study of the previous problems, the student ought now to be able to construct this problem and develop the patterns. Your attention is drawn to the peculiar shape of the mitre line in Fig. 35, the pattern in Fig. 36, and of the opening, Fig. 37.

NEW PRACTICE IN UPSETTING.

THE Ford Motor Co. has placed orders for upsetting machines, the aggregate value of which will approximate $350,000, says the Iron Age. This equipment is to be installed in a new building to be erected at once, the extension of capacity being occasioned by the development of a new method of upsetting circular pieces having an open centre, such as gear blanks, collars and other forgings ordinarily made heretofore on hammers. It is not long since that it was impossible to secure such pieces with the central hole punched through, all of this metal having to be drilled out. More recently this practice has improved, and the machining required has been limited to drilling the hole to size, although even in this case considerable metal has had to be removed.

Process Features.

The practice which is being developed by the Ford Motor Co. for pieces of this character, not only provides for forging the hole in the centre within such limits of size as to require only a finishing cut in the machine shop, but results in the piece being formed without any waste of material. Even the flash is eliminated. While the process in general has not been sufficiently completed to warrant detailed description, it consists of upsetting pieces of the general form described, from bar stock of the same diameter as the central hole in the finished forging.

The work is done in two or three operations, depending upon the relation of the finished outside diameter of the forging to the diameter of the stock. The diameter of the stock may be safely increased 1½ times. In the first operation, the end of the stock is pierced and spread; in the second operation the upset end of the stock is partly formed in a way which prepares for the third and finishing operation the exact amount of metal required, so that the piece finishes without any flash to be trimmed in a final operation. The third operation involves the simple stripping of the forging from the stock, the punching removed from the centre of the forging remaining on the bar and being worked up into the next piece, so that there is absolutely no waste of metal.

On some pieces it is possible to combine the first spreading operation with the stripping operation which finishes the preceding piece. At the Ford plant an interesting revision of machining operations will follow as a result of this new forging practice.

CANADIAN GOODS NEEDED IN RUSSIA.

RUSSIAN banks are interested greatly in Canada's determination to enter the Russian market, according to a further report received by the Department of Trade and Commerce, Ottawa, from C. F. Just, special Canadian Trade Commissioner. Mr. Just gives an extended list of articles which could be made the basis of a large trade between this country and Russia. He again emphasizes the desirability of the establishment of agencies in Russia, especially in regard to the trade in agricultural and other machinery, the United States manufacturers having erected works which, when in full working order, will take care of one-sixth of the total annual requirements of the country. Russia needs the light type of agricultural machinery, and the trade, says the commissioner, is capable of indefinite extension. A Canadian forwarding agency in Russia is recommended. Mr. Just states that the forwarding business has been in German hands, and that "it has been attended with disagreeable surprises since the war began."

NON-RUSTING OR STAINLESS STEEL.

THE fact was lately mentioned in a United States consular report from Sheffield, England, that a firm in that city had introduced a steel which is claimed to be non-rusting, unstainable and untarnishable. The steel is especially adapted for table cutlery, as the original polish is maintained after use, even when brought in contact with most acid foods. It is an interesting fact that the steel was not made with a view to producing cutlery, however. The investigator was endeavoring to produce a steel for pump rods used in collieries, where a damp atmosphere had to be resisted. The application of the steel to cutlery was but a natural sequence, and no doubt a multitude of other uses will be found for it. In a tempered condition the steel has a maximum strength of 50 to 55 tons per square inch, and elongation of 20 per cent., and a reduction of area approaching 60 per cent. In the hardened condition the tensile strength is raised to about 100 tons. It is claimed that the steel retains a keen edge, much the same as the best double-shear steel. This stainless steel is made by Messrs. Thomas Firth & Son, Ltd., of Sheffield, England. Obviously there are many situations where a non-tarnishable steel would be much more satisfactory than the present steels.

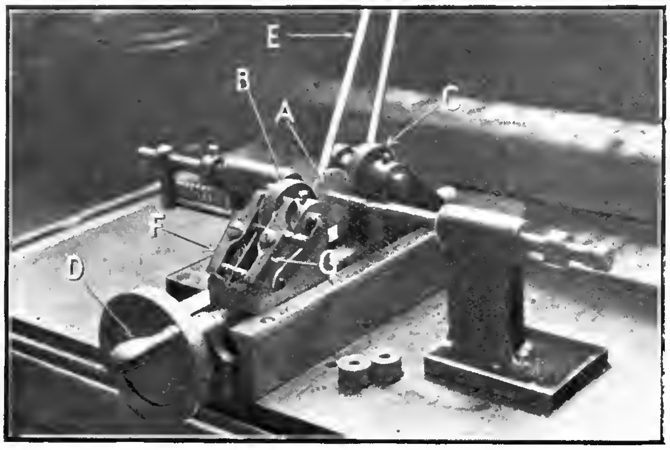
PRODUCTION METHODS AND DEVICES

A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

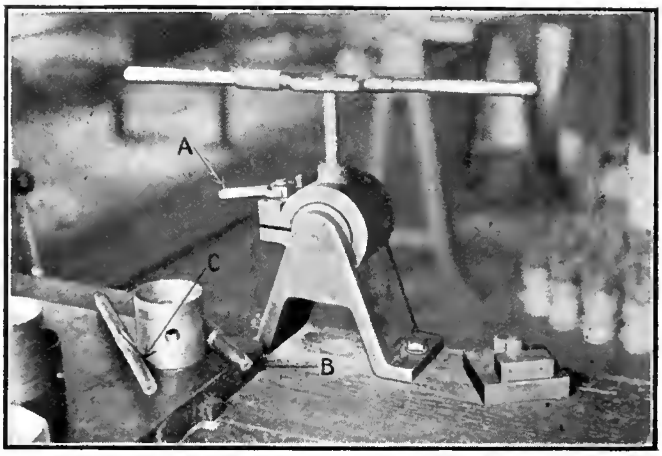
KNURLING SMALL BRASS GEAR TEETH.

By Avery E. Granville

AN unusual method of forming gear teeth is here shown. The small brass gears are used on a talking machine, and run as smooth as any cut gear possibly could. The brass blank on which the teeth are to be formed, is placed at A between the two knurls B and C, which are really master gears. These knurls are fed in to the blank by turning the handwheel D which operates a right and left-hand screw, so that the knurls are fed to the blank simultaneously from opposite sides, preventing undue strain on the spindle of the blank. Power is obtained through the belt E which drives the rear knurl. The jaws F and G are padded on the ends which press against the front knurl, and act as a sort of brake, preventing chatter or backlash. The teeth are formed much quicker than is possible in any other way, except in a case where they may be all cut at once in a punch press die. The burr left on the edges of the gear by the knurls is easily trimmed off in a small lathe.



KNURLING BRASS GEAR TEETH.



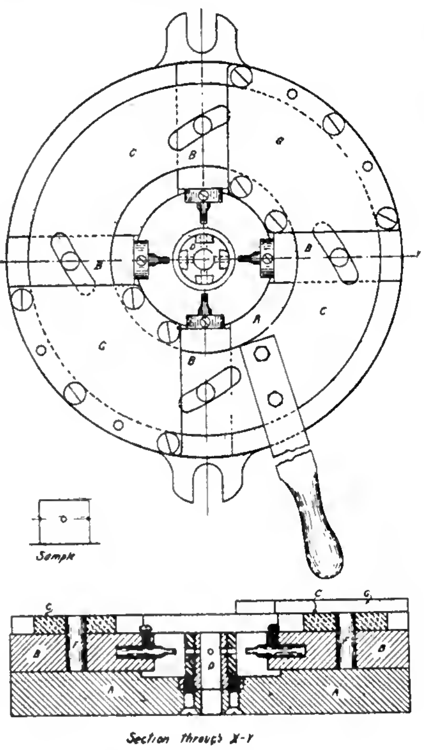
PISTON LINE-REAMING JIG.

RADIAL HAND PUNCH.

By S. Simpson.

THIS device was gotten out for the purpose of punching four holes simultaneously in small cylindrical shells or cups, see J in the illustration which also shows plan and sectional elevation of fixture. Block A is a casting having suitable lugs provided for bolting to a bench. Four radial slots are made to act as guides for the punch holders B, which are square section cold rolled steel. In the top face of casting A, a wide, shallow groove is turned to receive the steel ring C, which forms a cam plate. The bottom of the groove is made to just clear the upper side of punchholders B, so that cam plate C acts as a retainer for these pieces. Suitable cam slots are made in C to engage with hardened steel pins F carried by punchholders B.

Two segmental plates G are each secured to the main casting A by five countersunk machine screws, and are adjusted so that cam plate C may be



RADIAL HAND PUNCH.

oscillated by hand lever H, thus causing the cam slots to act on pins F and force the punch holders toward the centre of block A. Die block D is of cast iron and is fixed in a recess by screws from below. The dies proper are made of hardened steel and are dovetailed into block D, through the centre of which a hole is made to allow punchings to fall through. The steel punches are held in holders B by small screws as shown. This style of fixture worked well when constructed for two and also for six punches.

PISTON LINE-REAMING JIG.

By A. E. G.

MOTOR pistons, that have the wrist-pin hole drilled and reamed in a turret lathe, must have the hole hand-reamed afterward, in order to keep the size accurate. A very good holding jig for the hand operation is shown in the illustration. The clamping band is operated by means of a bolt and nut, the latter being turned by the small lever A.

When first putting in the piston, it is located in line with the guide bushing by means of the locating plug B, which is tapered on the end to facilitate insertion. The reamers used are cut left-hand spiral so as not to bind or feed in too fast. They are also piloted as shown at C, the pilot fitting into a bushing in the bottom of the clamping ring. Two reamers are run through each hole, one to accurately line it up, and the other to bring it to exact size.

ADJUSTABLE DEVICE FOR HAND PUNCH PRESS.

By H. Womersley.

IN the construction of large steam turbines many operations and adjustments are necessary which vary considerably

from what has been developed in the building of ordinary steam engines.

The thousands of blades which enter into the construction of a turbine must be securely fastened in place, and many different systems of doing so are in use. Some of these necessitate the use of bands to retain the blades in position. These bands require to have holes punched so that they may be slipped over the blades into position. In the case of a turbine of 12,000 horse power, there were forty rows of blades on the rotor or revolving member, and the same number on the casing which surrounds the rotor. As it required on an average six bands to fasten one row of blades there were almost 500 bands required for this particular machine. These forty rows of blades were located on different diameters of the rotor and casing, causing a variation in the pitch of the holes in the bands.

Object of Device.

The device shown in Fig. 1, was made up so that the holes in the bands could be punched quickly and accurately to any required pitch. Adjusting shaft A is supported in two bearings B and C. Collars are provided on both sides of B to prevent any endwise movement of A. Block D is tapped to make a good fit on shaft A, and is provided with a pin on the underside to slide in a slot on bed plate. Frame member E is pivoted on top of block D and frame member F is pivoted on top of bearing B. Spacing strips G are now fastened to frame members E and F. These strips must be exactly alike, and the holes in the frame members to which they are fastened must be laid off on a perfectly straight line, and corresponding holes must be accurately spaced from centre of pivots in ends of frame members. A hand wheel H is provided, by turning which block D may be moved to any desired position on shaft A.

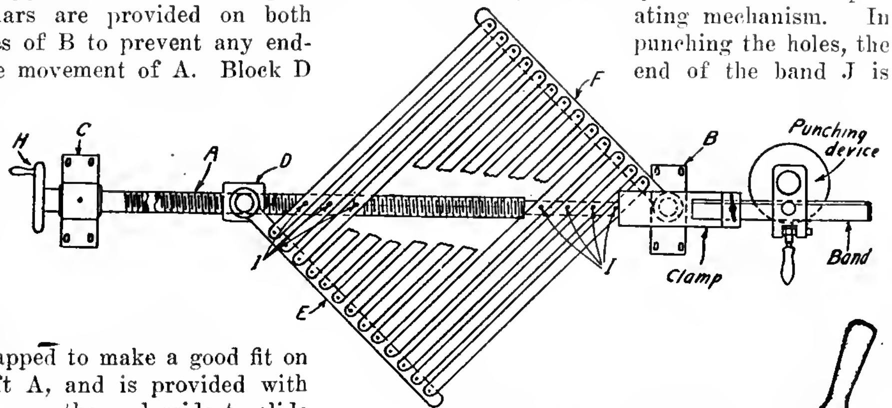
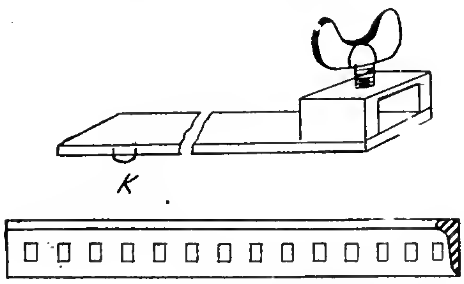


FIG. 1. ADJUSTABLE DEVICE FOR HAND PUNCH PRESS.



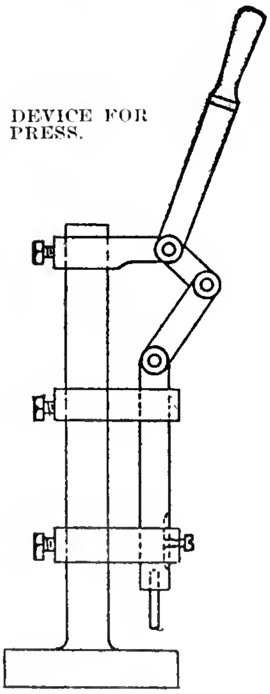


FIG. 2. PUNCHING MACHINE, CLAMP, AND BAND.

Method of Operation.

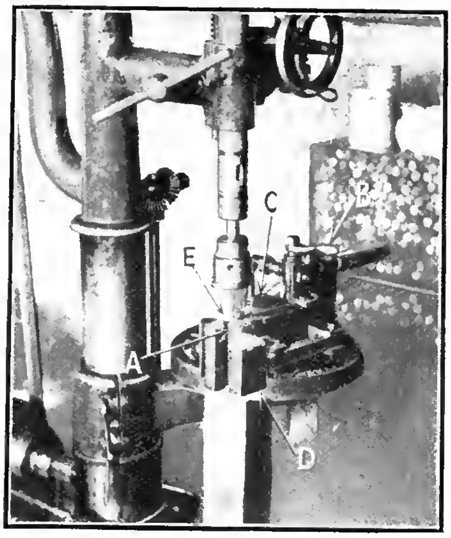
When the apparatus is assembled and mounted on a suitable bench, block D is located in a convenient position and a straight edge securely fastened to pivots D and B so that the jig holes I in strips G may be located on a straight line which extends from centre of pivot B to centre of pivot D and which is parallel with shaft A in a vertical plane.

When block D is moved in either direction on shaft A, the strips G and therefore the jigholes I will move closer together or farther apart, thus allowing the pitch of jig holes I to be adjusted to any required pitch within the capacity of the frame.

By making shaft A long enough, any number of jig holes may be provided.

The punching machine Fig. 2 is made of a piece of cold rolled shaft screwed into a cast iron base for fastening to the bench. The punching spindle is carried in two guides made of flat bar stock and fixed in position by set screws. A toggle joint lever provides suitable operating mechanism. In punching the holes, the end of the band J is secured by wing nut in clamp Fig. 1. Pin K on the underside of clamp is placed in jig hole next pivot B, and the first hole punched, after which pin K is moved to next jig hole, and so on.

The spacing device is simple and when accurately made gives very good service. Many opportunities may happen when a device of this nature will be found very useful in different lines of manufacture.



STAY BOLT DRILLING FIXTURE.

STAYBOLT DRILLING FIXTURE.

By G. Edwards.

ONE of our big railroad shops uses the air clamping fixture shown, to hold staybolts while drilling the tell-tale holes. The staybolt is placed at A and the air is turned on by means of lever B. This admits air to the cylinder C and causes the jaw D to move in and lock the staybolt into the V-groove in which it rests. A drill bushing is carried in the bracket E to guide the drill. Connection is made to the shop air supply through a short piece of hose. When not in use, the device is easily removed, leaving the table clear for other work.

The Steel Company of Canada, Hamilton, Ont., has been making remarkable headway in shell-making, according to official advices. Orders obtained by the Shell Committee called for something like 650,000 shells, and out of the 605,000 delivered to date, rejections only amount to the insignificant number of 62, making an almost perfect showing for the plant. Why the officials are particularly pleased with the result is that it was only in February that they started on the erection of the plant which is being used for the manufacture of shells, and the entire plant is manned by the company's own men, who have turned from their ordinary work to the special lines that are now being required.

EDITORIAL CORRESPONDENCE

Embracing the Further Discussion of Previously Published Articles, Inquiries for General Information, Observations and Suggestions. Your Co-operation is Invited

ELECTRIC POWER IN MANUFACTURING ESTABLISHMENTS.

By H. Womersley.

THE progress of electric driving in machine shops and factories has been so gradual and persistent that many persons never stop to think how widely it has been adopted. Instances of reverting to former mechanical methods of transmission, are extremely rare, and a brief resume of the principal factors which have influenced the development of electrical power may serve to remind many of us of conditions which previously existed and which would not now be tolerated in any progressive establishment.

Increased Transmission Efficiency.

This is generally the first point to be considered, but it is by no means the most important, as the cost of power in manufacturing is rarely more than 1 to 3 per cent. of the cost of the finished product, the expenditure for labor alone being usually many times greater. There is a practical limit however to the power that can be transmitted by belting from a single unit. On the other hand an engine or turbine may be directly connected to an electric generator producing 10,000 horsepower or more, the whole of which can be readily transmitted and sub-divided, also combined with the output of other generators. Thus the power of the individual prime mover can be increased to almost any extent provided it is utilized electrically. Enormous pumps or air compressors are almost the only machines except electric generators that are adapted to be driven by engines of 5,000 horsepower or more. For thousands of other power applications, the size of prime movers, including steam and gas engines as well as steam and hydraulic turbines, is practically limited to units of moderate size if dependent upon mechanical transmission, and distribution by belting or gearing. Of course these statements do not apply to steam vessels, in which many thousands horsepower are often applied to a single propellor, this being a case of direct connection. They do apply, however, to the electric-railway service, for which one very large engine in a power house may replace many steam locomotives. The advantage of large units compared with small ones include saving in first cost, floor space, fuel and attendance.

Cost of Buildings.

Heavy overhead shafting is not required for the electric drive, hence the buildings may be made lighter and cheaper in construction, as they do not have to carry the large extra weight. Moreover it is not necessary, as with long lines of shafting, to take special precautions in order to avoid any settling which would throw them out of alignment and cause serious friction losses, vibration, etc.

Cost of Equipment.

The relative expense of equipping a factory with electric motors or with belting and shafting is not usually much if any greater for the former, even if we do not consider the lower cost of the lighter building construction.

Clear Head Room.

The elmination of overhead belting and shafting by the use of motors gives a clear head-room, which enables overhead cranes to be used freely; a fact which results in great saving of time and labor in the bringing of the work to the tools or removing finished pieces. The clear head-room also gives better illumination and ventilation. In fact the saving in cost of proper illumination may be very considerable because general instead of local lighting may be obtained, whether natural or artificial.

Convenience for Detached Buildings.

The electrical method enables power to be supplied easily and economically to detached buildings or sections, which is not possible with belt or steam transmission; therefore, the buildings, like the machinery within them, can be located for general convenience, and not with special regard to supplying them with power. This sub-division of an industrial establishment into a series of detached buildings is an almost absolute safeguard against total destruction by fire; and is thus a practical guarantee of continued earning capacity. If electric power were not employed, it would be necessary to have very extended belting and shafting connections, involving great losses and extra heavy wall construction, or a number of small power plants with a larger force of men considerably less economical in operation than one central power house.

Freedom for Growth.

For similar reasons, with electric drive it is a simple matter to extend a building, or add another in any direction, whereas shafting must be installed originally large enough to allow for extension; or else it must be replaced later; in which case the operation of the existing line shafts would be interfered with.

Increased Output.

Owing to its many advantages, but especially on account of clear head-room for crane service and convenient speed control, it is found that the output of manufacturing establishments is in most cases materially increased or the running expenses decreased by the introduction of electric drive. An added output of 20 or 30 per cent. is often obtained from the same plant, which in itself is sufficient to make the difference between profit and loss in carrying on a manufacturing business.

Overtime Work.

Also work on holidays or during strikes, may be carried on conveniently and economically with a portion of the machinery or even with a single tool, because a small engine and generator may be run to supply the electric power. On the other hand, the main engine and the whole or a large part of the shafting and belting would have to be operated in order to supply the power by the ordinary mechanical transmission.

Noise.

The elimination of noise is a desirable feature of electric driving. Line shafts with rumbling gears and slapping belts, with their attendant dangers and constant demands for attention and upkeep being entirely dispensed with when electric drive is adopted.

HOW I FELT NEAR A DANGEROUS BOILER.

By W. F. S.

I HAD a sort of sneaking suspicion that the boiler was going to blow up. Chris, the fireman, had allowed the water to go down out of sight in the water-glass and below the gauge cocks. He said he hadn't seen water for an hour, and, growing frightened, he came to me for succor.

My remedy was to draw the fire and shut down the plant, which we did right hastily.

While performing this operation I moved about as nimbly as Chas. Chaplin, I'll wager. Was on my tip-toes most of the time, my idea being that if she blew up I wanted to go up with her as easily

as possible. You always feel that there will be less concussion when on tip-toe.

I suppose the feeling of the soldier is much the same when he sees enormous cannon staring him in the face, and is told that he must charge against them. Hence, I often wonder if soldiers run on their toes. They all must be possessed with the maybe-it-will-happen, and maybe-it-will-not feeling.

After all is over the joy of living is intensified for a few moments; but soon the **big** boss comes along, and what he says sort of spoils the story. I shall therefore close. However, the feeling is unique.

CONCERNING BELT SLIPPAGE.

By R. McLaren.

AFTER reading N. G. Near's article in Canadian Machinery, July 22, I am still unconvinced that a slipping belt necessarily means fuel waste. Mr. Near uses as an illustration a hoisting engine, holding stationary a 33,000 pounds weight and states that it takes no more power to raise the latter than to hold it stationary.

We will assume that the weight is suspended from the drum by a cable and that the cable slips on the drum, the tension being adjustable in a manner similar to the brake band. We will assume also that the drum has a radius of 1 ft. and that it turns at the rate of 100 r.p.m. The power required to hold the weight stationary would be $2 \times 1 \times 3.1416 \times 100 \times 33000 = 628.32$ h.p. How then would he cause the weight to rise?

I would do it by running the engine faster, or by increasing the tension, and I think Mr. Near will admit that running the engine faster will require more steam. Anyway the firemen will admit it. We have already found that reducing the tension reduces the pressure on the scales, and therefore the steam consumption. Conversely if we increase the tension and reduce the slip, more steam will be required to maintain the speed of the drum at 100 r.p.m. Does he claim that it is as easy to climb a stair as to walk along a level floor?

He also cites the gas engine to prove his claim, but we are evidently not congenial spirits for here again I cannot agree with him. To be sure the slip occurs when the tension is greatest, but it simply means that the speed of the flywheel is increased, that is, energy is stored up in the wheeel to be given out again.

As a matter of fact, if the engine is underloaded, enough energy can be stored up in the wheel to carry the load over several cycles. Of course, in that case there is waste of fuel, but it is due to excessive cooling of the cylinder walls and is not the waste to which N.G.N. refers.

Evidently belt slip does not necessarily mean fuel waste.

THE MIRROR OF PRACTICE.

By N. G. Near.

YOUR face is dirty. Somebody has told you that it is dirty and you half believe it, but anyway, to convince yourself you look into a mirror and there, sure enough, you see the image of the dirt. Now, what do you do to remove the dirt? Do you wash and polish the mirror? Doing that would only make the presence of the dirt more evident. You can't wash your image and get rid of the dirt. You must wash your face. It is always best to apply the preventive at the source. No matter what you do to the effect, the cause remains unaltered.

In power plant practice, therefore, you can chip scale until doomsday, and it will keep right on forming in the boilers. To keep it out, the water must be treated, not the scale.

Black smoke is pouring out of your stacks. You don't make it white by adding smoke of a different color. You stop the smoke by burning the coal properly.

Your bearings run hot all the time. It would be foolish to keep on re-babbitting without applying oil.

The engine knocks or the turbine rattles. You don't build a muffler around the engine to stop the noise. You stop the noise at the source.

When things go wrong in general, therefore, don't blame the things themselves. Don't always blame the owner, the manager or the superintendent. Maybe **you** are the source yourself.

The image you see in the mirror of practice may be a reflection of yourself, so cleanse yourself.

MAKE STEAM PIPES A TRIFLE SHORT.

By N. Y. C.

A METHOD for dimensioning lengths of steam pipes that may be romoved easily in case repairs are needed is now being used by an Eastern designer holding a responsible position with a well-known engineering company.

Usually, where a straight steam pipe line is laid in an average boiler room, little if any allowance is made for pipe expansion when under steam. The expansion is permitted to take care of itself which often is the cause of creating dangerous stresses in the pipes and auxiliary connections.

To overcome these stresses in places where bends are to be avoided as much as possible, this designer makes the pipe initially too short—about 1-10 inch for every ten feet, or one inch per hundred feet. The longitudinal stresses are therefore in the pipe when cold—in tension. And should it be desired to take a length out, a bolted flange-pipe may be dropped out easily.

When under steam, the shortage is taken up by expansion and it is computed that there are no longitudinal stresses in the pipe whatever. This is as it should be for insurance of safety.

BRASS MELTING QUERY ANSWER.

FROM the information given in the "Brass Melting Query" which appeared in a recent issue, it is somewhat difficult to give a very intelligent answer as it is not stated whether the metals are new or scrap. From the facts at hand, however, it would seem that some of the metals have an excess of dross or slag.

As regards using charcoal as a flux, I might say that charcoal is used as a covering only to protect the metal from the air, and has no other effect on the metal. Salt is a great help in melting brass, but should be used at the proper time, that is, just as the first metal begins to melt. A handful of salt to the ordinary crucible is sufficient.

The best means to overcome the stated difficulty is to melt meal in crucibles and pour it into ingot moulds, using plaster of Paris for a flux. This material when so used dissolves all the foreign matter that may be present in the metals in the form of sand, oxide or slag. It forms a very liquid slag and has no bad effect on the crucible like some fluxes but rather keeps it clean. About 5 lbs. of plaster of Paris to 50 lbs. of metal should give good results. It should be mixed with the metal as it is charged into your crucible.

Melt the metal in the usual manner, and, if the slag is not fluid enough at the conclusion of the melt, add more plaster of Paris. Do not attempt to skim metal when it is ready, but pour into ingot moulds. The slag will all rise to the top and when cool, the slag of the plaster of Paris can be easily detached by a few blows of a hammer. Remelting will produce good castings.

It is not practical to melt metal as for iron as it would be too much exposed to the air and would be sure to absorb some injurious gases.

The Steel Company of Canada, Hamilton, Ont., has made arrangements to increase its open-hearth steel capacity to take care of the large orders it has received from England and from the Canadian Car & Foundry Co.

CONTEMPORARY WAR ARTICLES

Embracing Information and Data Drawn from a Variety of Sources Relative to and Arising from the Prosecution of this Many-Sided European War

THE YEAR'S WORK AT SEA.

WHEN, in 1804, Nelson had been cruising for fourteen months off Toulon, hoping and praying that the French fleet would come out and give him battle, says the naval correspondent of the Globe, the City of London made the egregious mistake of sending him a vote of thanks for—to quote Southey—"his skill and perseverance in blockading that port so as to prevent the French from putting to sea."

Nelson, already sore because the city had omitted its customary thanks after the destruction of the Danish fleet at Copenhagen, was not slow to seize the advantage which this communication offered him. "I beg to inform your Lordship," he wrote to the Lord Mayor, "that the port of Toulon has never been blockaded by me; quite the reverse. Every opportunity has been offered to the enemy to put to sea, for it is there that we hope to realize the hopes and expectations of our country."

The error of the City Fathers was not a very heinous one, for, after all, there is little difference from the enemy's point of view between remaining in port under compulsion and coming out to destruction; in either case the ocean highways are closed to him and free to his superiors. That was the case of the French and Spanish navies during the 29 months' wait of the British fleet that led up at last to Trafalgar, and it is the case of the German fleet to-day.

Superiority in Guns.

A year of war has passed without any serious attempt on the part of the enemy either to challenge our command of the sea or to diminish the margin of superiority by which we hold it; and as far as the so-called high sea fleet is concerned it is not easy to see what it could have done of greater benefit to its country than to keep safely out of harm's way. We do not know what the measure of Sir John Jellicoe's superiority may be in ships, but it is considerable; and it is enhanced to a great degree by the folly of Krupp commercialism, which bound the German navy down to the 12-inch gun while we were mounting the 13.5 and the 15-inch.

The first year of hostilities has, however, forced upon the notice of the world a factor of far greater importance than ships and guns. The German seaman has proved himself a man not lacking in courage. Whether we take the ships that went down off the Falklands, or the battering which the stranded Emden stood before a seaman swarmed up her mast and tore down the colors that were nailed to it, or the officer of U-18 who chose to sink his ship and himself with her rather than she should fall into our hands—these incidents are evidence of a courage that must compel our respect. At the same time, there is a canker gnawing at the spirit and efficiency of the German fleet that must tell increasingly in our favor as time goes on.

German Sea-Sense.

On August 18 last year the Admiralty reported that there had been "desultory fighting" in the North Sea. What it amounted to we have never been told; but it is the only occasion so far on which British and German forces have been in conflict in those waters without the hostile force being totally destroyed or badly mauled, or else running full pelt for its harbors at the first sight of a British ensign. It is true that in most of these meetings the balance of strength has been on our side—which is but a testimony to the efficiency of our own and the inefficiency of the German staff.

Count Reventlow has told us some pretty tales about the Dogger Bank action of January 24; and this, as it happens, affords us a very useful illustration of the subject of this article. The Blucher, he tells us, "ought not to have been brought into the battle at all." That is obvious to the most casual of arm-chair strategists; but to what degree has the confidence of the German navy in its rulers been increased by this act of sheer, criminal folly? The ex-lieutenant also points out, correctly enough, that the British ships had the advantage in gun calibre; but he surely does not forget that the German people and the German navy have been assured again and again by Von Tirpitz himself that the Krupp 11-in. was better than our 12-in., and their 12-in. at least as good as our 13.5. In this matter, again, surely there must be some doubts arising in the fleet as to the sea-sense of its managers.

It is not necessarily a disgrace to flee before a superior force, though it is not a habit that has been cultivated by our own fleet in this war or any other; but what do the German Puggs (no disrespect) talk about when the day's work is done? Is it about the "raid" on Yarmouth in November, when a squadron of battle and armored cruisers fled so precipitately before a few of our light cruisers (which they could have eaten) that one of them careered into a German mine-field and sank? Is it about the plucky fight which the 22,640-ton Goeben and the 4,480-ton Breslau put up against the mighty Gloucester, whose entire broadside weighs less than a half of a single shell from a Goeben gun? Or is it about the victories that the despised Russians have won in the only two stand-up fights that have so far occurred in the Baltic?

It is possible, no doubt, to feed up the German public with stories about the Tiger and similar "incidents"; but the seaman knows—he was there, and he knows that his government is backing up his poor best with lies. Unless he is in a submarine he knows he has never seen a British warship but to run away from it. He knows that, in four set scraps in the North Sea, eleven German cruisers and torpedo-craft have been sunk at a cost to us of an armed trawler. He knows that it is risking almost certain destruction to venture fifty miles beyond the limits of his mine-fields.

Good Gunnery Means Good Nerves.

Count Reventlow tells us that it has always been manifest that the German ships shoot better than the British, yet one whole squadron bombarded Yarmouth without even hitting the beach, while another fired several concentrated broadsides at a 500-ton destroyer and fled with a casualty list of one killed and eight wounded to its credit. German gunnery is not underrated in the British Navy. It is admittedly good, but it goes to pieces when the other ships—our ships—begin to hit back. This is the natural corollary of the usual roles occupied by our ships and the German.

Good gunnery requires good nerves, and to be in a fleeing ship with no object in view but to get safely home with a sound skin and a whole vessel is not conducive to steady nerves. Stern, close fighting, whenever possible, will always develop and emphasize the difference between our long-service seamen and the pressed three-year men who form the bulk of Germany's naval personnel.

To sum up—The moral ascendancy which our fleet has established in the first year's war is bound to increase as time goes on, for good seamen are not made by constantly shirking action, however much the shirking may be justified on other grounds. Of our own fleet little need be said. When we repeat Mr. Balfour's trenchant summary that "no fleet could have done more" we have said enough, save only one thing. There

is no greater augury for the future than the feelings that are entertained for Sir John Jellicoe by every officer and man under his command. It is doubtful if Nelson himself ever inspired more confidence and affection.

WAR AND INVENTION.

NOW that the names of those who are to be associated with Lord Fisher in the work of the new Inventions Board are announced it is clear that a serious effort is to be made to call in the aid of science to the more vigorous prosecution of the war at sea. It is true that apart from Lord Fisher there are no practical seamen on the board but, doubtless, the officials of the new department will include those with sea-going experience, so that whenever an invention comes up for consideration the arduous conditions of sea service may be in mind. It is common knowledge that devices which may suit laboratory conditions would be of no avail under the stress of actual service. On the scientific side the Board and the Consultative Panel constitute a strong body. The Central Committee will consist of:

Lord Fisher of Kilverstone, G.C.B., O.M. (president).
Sir J. J. Thomson, O.M., F.R.S.
Hon. Sir C. A. Parsons, K.C.B., F.R.S.
G. T. Beilby, Esq., F.R.S.

The Consulting Panel will comprise the following list, which will be added to from time to time as necessary:

Professor H. B. Baker, F.R.S.
Professor W. G. Braggs, F.R.S.
Professor H. C. H. Carpenter.
Sir William Crookes, O.M., F.R.S.
W. Duddell, Esq., F.R.S.
Professor Percy Frankland, F.R.S.
Professor Bertram Hopkinson, F.R.S.
Sir Oliver Lodge, F.R.S.
Professor W. J. Pope, F.R.S.
Sir Ernest Rutherford, F.R.S.
G. Gerald Stoney, Esq., F.R.S.
Professor the Hon. R. J. Strutt, F.R.S.

Stimulation of Research.

It is a list which may well hearten inventors whose aspirations have been chilled by official indifference, and whose genius has been allowed to stagnate for want of Government appreciation. The knowledge that future efforts in the field of invention are to be judged by such a tribunal should give a stimulus to research, from which important results may be expected. All branches of science with a leaven of industry, are represented on the new body. Electricians and physicists, engineers and inventors, professors and business men, all these are included. The Royal Society, Britain's premier scientific body, which has intimated its willingness to co-operate in the work, has furnished the majority of the committee and consultants, and it may be taken for granted that in this new body the best that the nation can furnish on the scientific side has been organized for the needs of the war as far as these may be served by new inventions.

One Urgent Need.

There are, of course, many problems in connection with the operation of ships of war, and their use as fighting machines, which remain to be solved, but the great problem of the moment is to find the real answer to the submarine, which undoubtedly threatens until the true answer is given, to become in future years the dominant type of warship. Already it is evident that it enables the attack to be delivered by the weaker power, and the new application of such vessels as commerce destroyers has indicated what might conceivably be accomplished by a great fleet of submarines.

It will be many years before the submarine reaches a position when it will be capable of effecting a real blockade of a considerable coast line, and long before that time there is no doubt that the real reply to the underwater fighting ship will have been found. It is important that Great Britain should find it. Already the somewhat crude methods which have been devised for checking the offensive power of the submarine have achieved much, but now that science has been definitely called in to aid the work it may not be long before the submarine is robbed of much of its fighting value.

If special attention has been directed to this question it is because its importance to a nation which must maintain the command of the sea is vital. There are, however, many other directions in which invention may find scope under the encouraging wing of the new board. Questions of ship propulsion, problems of naval ordnance, wireless communication, fire control—all these and many other questions are still far from being settled. The design and equipment of warships is never fixed for more than the shortest period: a single invention may revolutionize the whole science of naval warfare, the discovery of a new alloy may profoundly affect ship design.

There can be no finality in the contest of brains and money which up to the present time have maintained for Great Britain the sovereignty of the seas, nor must there be any truce, until wars shall cease, in the striving to assure to our country a navy which in ships, men and equipment will be superior to all others. It should be the object of the Inventions Board to contribute to this end, and the names of those associated with it are a guarantee that all that science, backed by engineering, can compass will be thrown into the national scale.

ENTHUSIASM.

ENTHUSIASM is the emblem of energy, not an epitaph of ended effort. Enthusiasm is business itch. Enthusiasm tells whether you are in a class or outclassed. Enthusiasm is energy "on the job."

Enthusiasm predicts your position tomorrow. The man that lacks enthusiasm has mud in his mental make-up. His place is in history. If you lack enthusiasm get out of the way, and let some fellow run that can show speed.

Enthusiasm is what gets you home from third—the power that compels you to stick in the home stretch. Enthusiasm is the zeal that puts zero in competition. Cash can buy, but it takes enthusiasm to sell.

One result-getter, one optimist, one enthusiastic, live wire, can do more to ginger up an organization than ten thousand dollars in additional salaries.

Self-reliance, self-confidence, hope, expectations, are some of the pillars of man's prosperity.

The despondent dub, the hopeless human, the forlorn fellow is sometimes tolerated on the payroll out of deference to those who are dependent upon him. It would be eminently cheaper, decidedly better, to pension this pessimistic parasite.

Then, there is the "old governor"—the so-called "conservative," the man who officially opposes everything. He is a candidate for respectable retirement, or for impeachment.

To-day it's go ahead or go behind—keep up or get off the trail. To-day it's the survival of successful men. To-day we hold the funeral for the flabby, the infirm in intellect, the groggy grouch.

Every big battle is first lost, then won by an enthusiast.

Enthusiasm is the biggest word in business to-day.—Silent Partner Magazine.

The efficient man is he who analyzes himself, striving continually toward an ideal—a standard—which embodies ultimate perfection. He is not satisfied with being adept in a few things, but must be proficient in all. He realizes that the underlying purpose of life is the formation of character, and so far as he succeeds or fails in this respect, the measure of his success lies. Therein, the lives of many of us fall short, for it is better to have aimed at a star and failed to touch the mark than neve rto have aimed at all.

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

NEW PRODUCTION BASIS FOR COLD-SAWING.

THE present demand for a very much higher speed in cold-sawing than has been prevalent heretofore has been the prime incentive in the perfection of new loading tables for multiple bar cutting, by the Earle Gear and Machine Co., Wayne Junction, Philadelphia, Pa. The demand originated from shrapnel makers, whose shops were not equipped with automatic screw machinery.

The steel used in shrapnel manufacture, as called for in the specifications of the Canadian Shell Committee, are as follows:—Carbon, .45 to .55; phosphorous, .03; sulphur, .14; manganese, .60 to .80.

This constitutes quite a difficult metal for rapid cutting off, but that on which the tests were made at the plant of the Earle Gear & Machine Co. was rather more so, on account of its higher carbon and special contents. The analysis of this latter was: Carbon, .50; phosphorous, .04; sulphur, .015 to .04; manganese, .60.

In the daily tests, covering a considerable period, nine 3½-in. bars of the latter material were placed on the loading table, and the saw run continuously for 24 hours a day, six days a week. The average cutting time for the entire nine bars, with a 21-in. inserted tooth milling saw blade, was nine minutes, or at the rate of 54 per hour. This is equivalent to seventy-eight 3-in bars per hour, and sixty 3¼-in. bars.

An additional test was made with a saw blade that had been used on almost a thousand bars, and, in spite of the fact that it had not been ground in the meantime, the cutting time for the nine bars was 10½ minutes, the start having been made at 2.29 p.m. and the last steel die falling off at 2.39½. This rate of production, it is understood, is guaranteed by the makers of the "Lea-Simplex" saw to be continuous, and since several of these machines can be handled by a single operator, it follows that both production and labor costs are much reduced.

One of the biggest factors in the quick cutting off of material is a simple and rapid means of handling stock. The accompanying blueprints show very clearly how the stock is fed into the machine, and how the gauge plate in front of it automatically produces the right length.

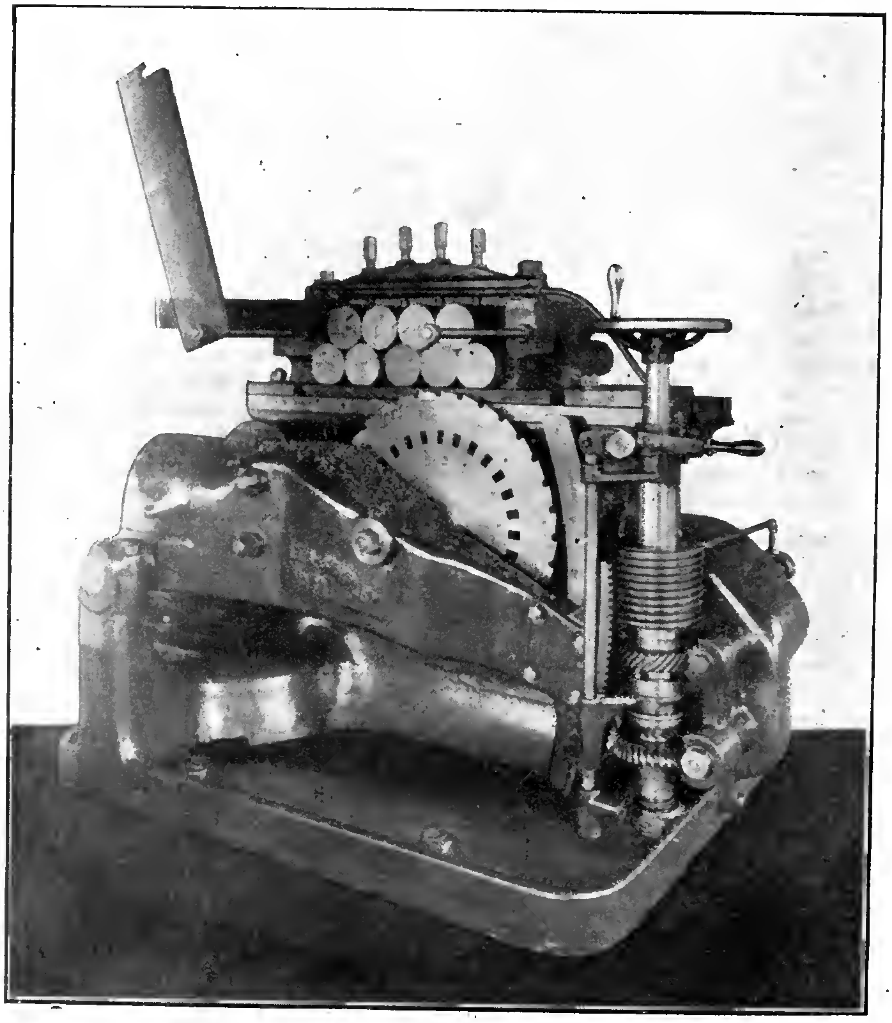
While it is generally possible for the saw to perform the actual cut with great rapidity, whatever advantage may be obtained in this way is frequently offset by inability to keep the machine continuously in motion. Quite naturally sawing must be interrupted during the feeding of new stock, and any decrease that can be made in this time will reflect favorably upon the ultimate production.

In many cases it has been observed that the time for changing stock is almost as great as that consumed in actual cutting. It follows, then, that the actual output of the saw may be restricted. Therefore, any decrease in the time required for placing the work before the saw blade will obviously make an appreciable increase in the output of the machine, even where its actual cutting speed is in no way affected.

With the exception of the new loading table and the new stock feeding device, the machine illustrated is practically the same as the standard No. 21 "Lea Simplex" saw. The frame consists principally of a one-piece casting, with heavy ribs, to insure rigidity. It is provided with three bearings, to carry the main drive shaft and the trunnions of the swing arm. The bearings are provided with self-closing, dust-proof oilers and bushings are of liberal proportions.

The top or work table part of the frame is planed, and has three T-slots machined from the solid and numerous pin holes for fastening and setting clamping blocks when the new form of multiple cutting off table is not used. The base of the frame casting serves as a tank for the cutting compound which is kept in circulation, and used over and over again by a centrifugal pump placed near the gear box.

On work of the nature described in this article it is customary to keep the tank filled with approximately fifteen gallons of cutting compound, and because of the evaporation an additional quantity of about two gallons per day. The compound used in the case of diffi-



EARLE GEAR & MACHINE CO. MULTIPLE BAR SAW.

cult metal consists of one pound of borax dissolved in cold water, to which is added one gallon of lard oil. When this has been thoroughly mixed, enough water is added to fill a three-gallon bucket. The pump is a self-primer.

At one side of the frame a pad is provided for motor support, on which a five horse-power motor is placed, the latter having sufficient speed and pulling capacity for any work that saw may be called upon to do.

The swing arm, which carries the saw blade into the work, is a rigid hollow casting, supported at three points. The three point suspension naturally tends to relieve the bearings of all side thrust and maintain the vertical cutting plane of the saw very accurately. In this way the saw blade is relieved of all twisting strain, and is far less subject to breakage than would ordinarily be the case. This construction also permits of the use of thin saw blades, with a consequent reduction in waste stock.

The outer end of the swing arm is a heavy quadrant, engaging a feed worm. The liberal size of the worm and the large cross section of the swing arm are conducive to very accurate and uniform feeding and prevent strain when the saw blade is suddenly relieved of its load, or where the cross section of metal being cut is either reduced or increased.

The support of the saw is an interesting feature. The bearing is bushed and extremely long in order to minimize wear and tear and obtain rigidity. Removable plates are fastened to the side of the arm to guide the blade and prevent loss of alignment; this assures a smooth, square-cut surface. Hardened tool steel is employed in the guides, being ground to a fit, while ample provision is made for adjustment to take up wear.

The sprocket drive is claimed to be absolutely positive and obviates every danger of slipping. The sprocket itself is secured to a crucible steel spindle, running in bronze bearings. At one end a bevel gear engages a mate on the main drive shaft.

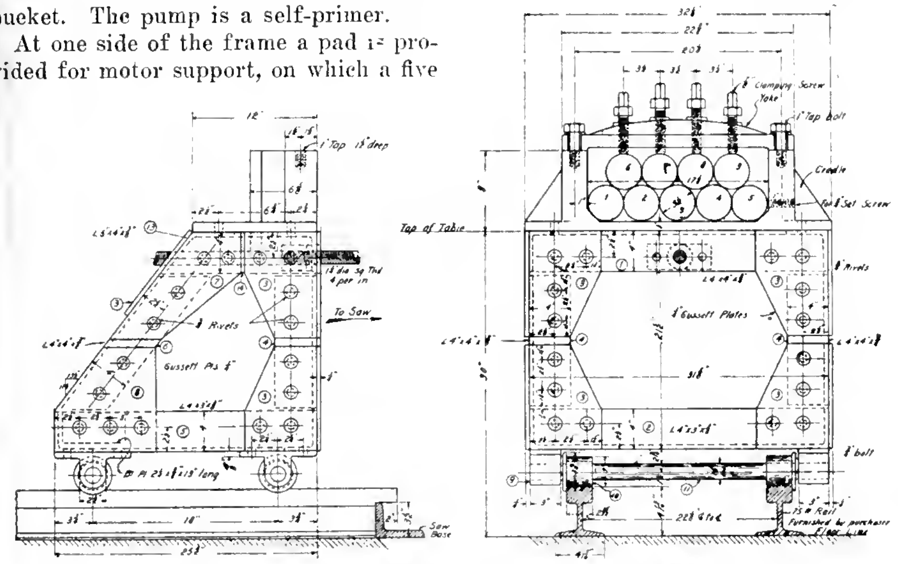
The radial slots in the saw blade, as will be seen in the photograph, are placed as close to the periphery as possible in order to produce a steady, powerful pull on the feed while the swing arm gradually sweeps upward. These changes are made available through a change gear feed box, which is controlled by a calibrated plunger. Its construction permits changes in feed while the saw is cutting.

Probably one of the most interesting and economical little devices used with the machine is the automatic friction control of the feed, which makes it virtually impossible to break the saw blades through overfeeding. A set of friction washers is placed directly on the worm shaft which feeds the swing arm. The resistance of these washers can be adjusted to almost any amount, so that when their predetermined resistance on the saw teeth is reached, feeding stops automatically until the resistance is relieved. The value of this feature is especially emphasized in cases where the annealing or rolling of metal has not been uniform, and hard spots are scattered about its cross section.

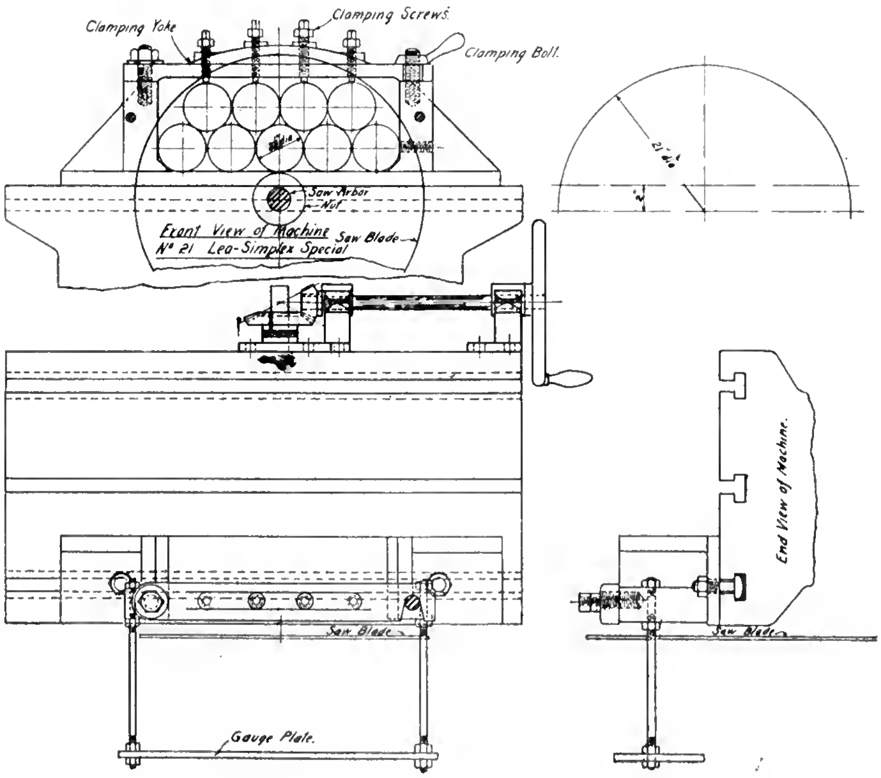
The feed mechanism, which is actuated by the gear box, consists essentially of a vertical shaft carrying a worm and two spiral gears, with a flexible feed return and a control rod for operating the clutch. It can be seen from the illustration how the large worm on the vertical feed shaft engages the quadrant fastened to the swing arm and feeds it up or down as the case may be.

An interesting feature of the control rod—easily seen in the illustration—is the fact that it may be operated by hand or automatically through the agency of adjustable dogs and tripping devices. In this manner the machine can be stopped at any predetermined point automatically. This is a good point, especially in the cutting of shrapnel blanks in multiples, because with the cessation of feeding all the power utilized for raising the swing arm is conserved. The floor space of the machine is comparatively small, although the length of bars employed for cutting shrapnel will largely determine this.

The newly developed rapid feeding



SUPPORTING CARRIAGE FOR CUTTING BARS.



CRADLE FOR CUTTING OFF BAR STOCK FOR SHELLS.

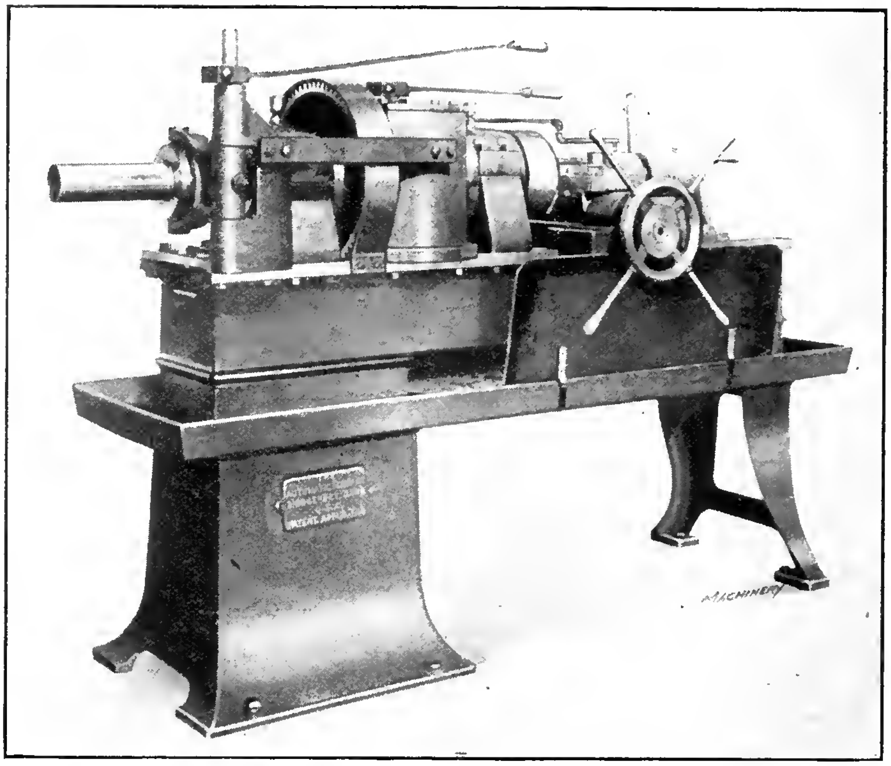
table consists of two units, one of which is mounted on the regular table of the machine, and the other, which consists of a structural steel table, mounted on rollers and running on standard steel rails. The rails are declined toward the front of the machine in order to secure the assistance of gravity in the movement of the stock. The amount of forward movement is controlled by a screw operated by means of a hand wheel placed conveniently on the operating side, which moves the stock positively to any desired distance.

That part of the feeding table which is bolted to the regular table consists of two cast steel cradles and two swinging cast steel yokes fitted with the necessary set screws required to hold the work. The lower part of the table is trussed and otherwise reinforced to prevent any sign of spring or movement whatever.

It is essential when cutting off is done rapidly to provide a means for gauging the length of the finished product quickly and accurately. Two machine studs protruding from the sides of the yoke supports are provided for this purpose, and are adjustable. At the under one a gauge plate, which can be seen very clearly, is swung in a manner that permits its pulling on the other adjusting bolts. When the stock is moved against this gauge plate by means of the bevel gear feed on the stock it is moved far enough ahead to cut possibly within one-sixteenth of an inch of the finished length.

CUTTING OFF MACHINE FOR STEEL AND COPPER TUBES.

THE requirements of the shell industry have justified the production of special machines for producing one- or more similar parts, such as copper bands, etc. The machine illustrated has been designed in response to the demand of shellmakers, but is also suitable for tubular cutting off in various branches of manufacturing such as roller bearings, etc.



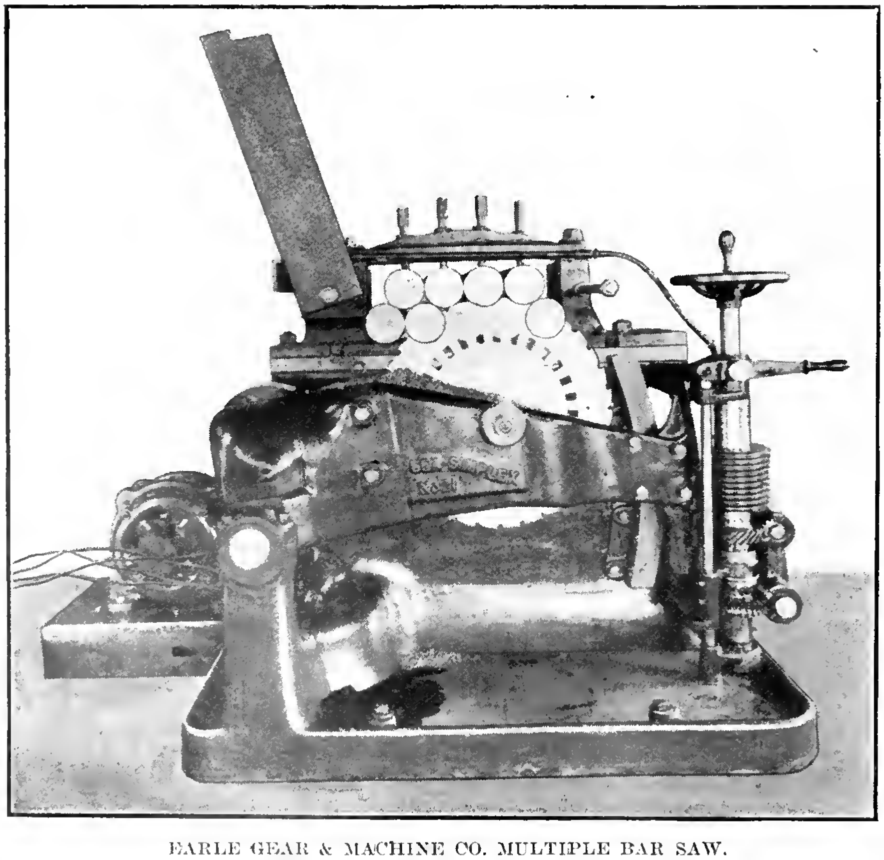
CUTTING-OFF MACHINE FOR STEEL AND COPPER TUBES.

The essential features are a large cast-iron hollow spindle running in cast-iron bearings bolted rigidly to a substantial bed mounted in oil pan with box leg oil reservoir, oil pump and piping. The spindle has spring collet chuck with spring feeding fingers reaching close up back of tube holding chuck.

The operation of the machine is by the two hand levers shown over the headstock and the pilot wheel on cross feed slide. The tailstock or stop has a releasing device so that the revolving tube will not come in contact with the stop while being cut off. The long lever over headstock is for feeding the tube, and the short one is for opening and closing the chuck. The cross feed is by hand, and the tool slide is fitted with multiple tool holder, so that three to six rings are cut off at one time.

The actual time necessary for one cycle of operation, i.e., to feed, chuck, and cut off three to six bands, is less than one minute. The whole machine is well made, rugged, and operates with a minimum of effort by the workman. With modifications, it can be used for trimming either end of shrapnel or high explosive shells, for finish turning the bands, for cutting steel tubing, and many other classes of work where a large hollow spindle with spring collet chuck can be used to advantage.

The machine is made in two sizzes, the smaller one having a capacity through the spindle of 3¾ inches dia., and the



EARLE GEAR & MACHINE CO. MULTIPLE BAR SAW.

larger machine 6¾ inches dia., while both machines have a maximum capacity of 18 inches between face of chuck and stop. They are completely designed with stop, stock support and multiple cutting off tool post, and the equipment includes countershaft, oil pump, pan, tank, piping, guards, and tools for any one size, length and diameter of tube. The net weights are 2,700 lbs., and 3,300 lbs., respectively, while shipping weights are 3,300 lbs., and 4,000 lbs. The Automatic Machine Co., of Bridgeport, Conn. are the builders.

CUTTING-OFF MACHINE FOR SHELL AND SHAFTING WORK.

THE illustration shows a specially designed cutting-off machine for cutting off all sizes of round bars from 1½-in. to 6-in. in vanadium and special alloys steels, as well as shafting bars, etc. It is built for heavy rolling mill work and will weigh approximately 11,000 lbs. The machine as shown is driven by a 20 h.p. motor and is capable of cutting off shell and shrapnel bars at the rate of one cut in forty to fifty seconds on 3-in. round material; other sizes in proportion. It is equipped with two universal chucks and has a double cutting head—one on each end. There are four tools in each cutting head, and four tools working on the material at one time makes it a very rapid cutting-off unit. With this arrangement the tools can be crowded practically to the limit all the time.

It has a special apparatus for backing the tools out by power at the completion of cut, the four tools being handled quickly. It also has an automatic stop which throws the tools out at the end of cut. A receptacle is provided for a liquid for lubricating the cutting knives, and a rotary pump is also provided for pumping the liquid for lubricating the cutters.

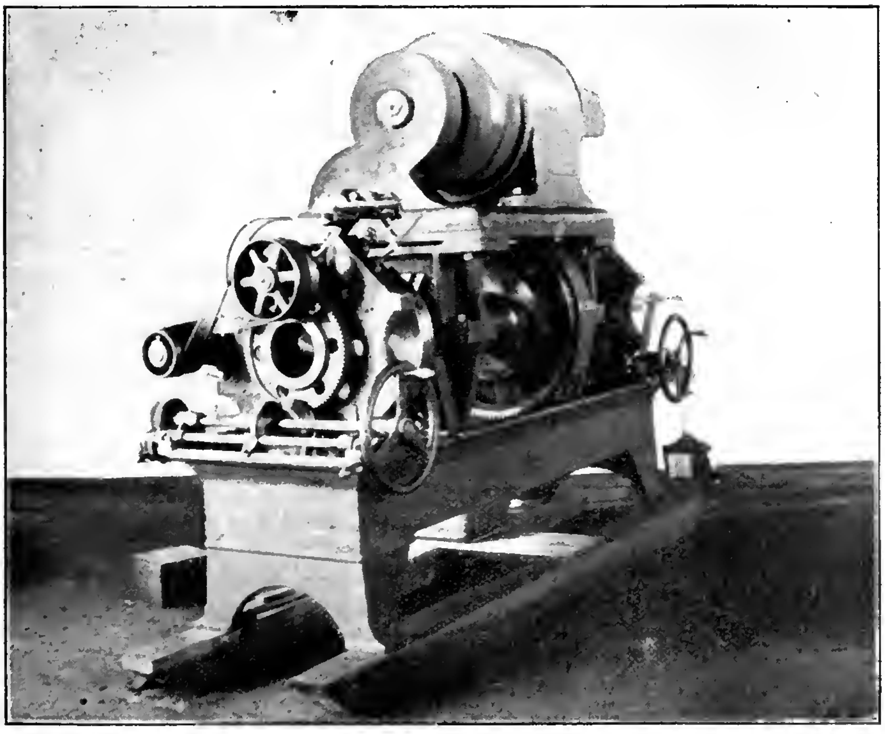
A particular advantage claimed for this machine where it is necessary to cut from ¼-in. to ½-in. stock off the end of long bars is that the bars are put in and one end is cut off by one cutting head; the bar is then pulled through and the other end is cut off by the other cutting head. This eliminates taking the bar out of the machine and turning it end for end.

A further advantage claimed is that in cutting up short lengths into still shorter pieces, such as gear blanks, etc., two pieces can be cut at one time with the double cutting heads. It is also provided with a measuring gauge for short lengths, which is attached to one end to be used in shell and shrapnel work, as well as on short pieces of every description.

When long bars are being cut, two specially designed stands are used, which, it is pointed out, permit the stock to revolve on the stands while being cut off. A cam-operated roll is provided for the stands to place the bar in position to be pushed through the machine without any drag.

The Brightman Mfg. Co., Columbus, Ohio, are manufacturers of this product.

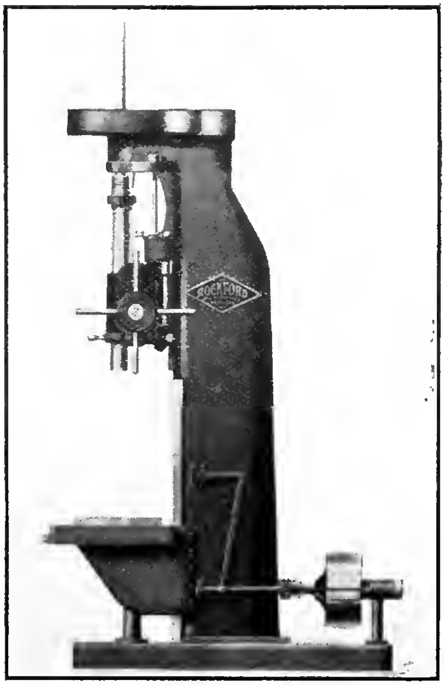
Sackville, N.S.—The Fawcett Foundry Co. are installing machinery for making shells.



CUTTING-OFF MACHINE FOR SHELL AND SHAFTING WORK.

HEAVY DUTY BOX COLUMN TYPE DRILLING MACHINE.

THE description and illustration refer to a heavy duty box column type drilling machine recently developed by the Rockford Drilling Machine Co., Rockford, Ill. It is rigid and heavy, is intended to drive high-speed drills up to 2½-in. in diameter in steel, and weighs approximately 3,000 pounds. It is made in the following arrangements:—



HEAVY DUTY BOX COLUMN TYPE DRILLING MACHINE.

1—With a pulley that gives only one speed and with a friction arranged for the starting and stopping of machine.

2—With a two-step back gear cone and a double friction pulley countershaft that will give four speeds forward and four reverse, or eight speeds forward.

3—With either a direct connected variable speed or constant speed motor. In the construction, only one set of bevel gears is used and these run at a high speed. The power at the top is transmitted to the spindle through three spur gears, the reduction being five to one. All gears are of steel with the exception of the large drive gear on the spindle; it is made of semi-steel. The spindle is of special high carbon steel and the rack of nickle chrome steel.

The feed is taken from the spindle and has a feed box that gives four different feeds, these being instantly obtainable by turning a small lever upward and downward. The hand feed is through a star lever which in its inner position, works directly on the cross spindle and gives a quick approach and return of the spindle. In its inner position, it works through reduction gears which give a very powerful feed for

hand facing or drilling. The trip is by means of a dial graduated to correspond with the graduations on the sleeve; a trip lock can be set to automatically trip the feed at any pre-determined depth. The worm wheel is of bronze and the worm is arranged so that it runs in an oil bath. The table has three "T" slots frough 4-in. diameter by 3-in. deep.

EQUIPMENT FOR AUSTRALIAN NAVAL DOCKYARD.

TENDER forms, specifications and drawings have been received by the Department of Trade and Commerce, Ottawa, from D. H. Ross, Canadian Trade Commission at Melbourne, covering machinery equipment required for the Commonwealth Naval Dockyard, Cockatoo Island, Sydney, N.S.W. Details of the requirements, including closing dates of tenders, are as follows:—

Section A.—Three 1,000 k.w.d.c geared turbine generator sets as per plan, viz., boilers, mechanical stokers, economizers, feed pumps, superheaters, piping and valves, coal and ash conveyor, crane, 1,000 k.w.d.c. geared turbo set, 225 k.w.d.c generator, rotary balancers, main switchboard and cables, condensers.

Section B.—Three 500 k.w. triple expansion reciprocating sets; two 750 k.v.a. mixed pressure exhaust turbine alternators—viz., boilers, mechanical stokers, economizers, feed pumps, superheaters, piping and valves, coal and ash conveyors, crane, 500 k.w. reciprocating sets, 750 k.v.a. mixed pressure turbines, 225 k.w. generator, rotary balancers, switchboard and cables, condensers.

Section C.—Three 500 k.w. triple expansion reciprocating sets; two 750 k.w.d.c. mixed pressure exhaust turbine generators—viz., boilers, mechanical stokers, economizers, feed pumps, superheaters, piping and valves, coal and ash conveyors, crane, 500 k.w.d.c. reciprocating sets, 750 k.w. mixed pressure geared turbines, 225 k.w. generator, rotary balancers, switchboard and cables, condensers.

Section D.—Five 600 k.w.d.c. Diesel engine sets, viz., 600 k.w.d.c. Diesel sets, 225 k.w.d.c. Diesel sets, rotary balancers, switchboard and cables.

Machine Tools for Engineering Department of Dockyard.

Machine Shop.—Turbine boring machine, vertical and horizontal planing machine, horizontal boring, tapping, studding, drilling and milling machine, horizontal drilling, tapping and studding machine, high-speed turbine rotor lathe, shafting lathe, heavy double-ended, heavy duty lathes, high-class lathe, high-speed high-class lathe, high-speed vertical boring mill, vertical turning and boring mill, vertical boring and turning mill, face plate lathe, cylindrical grinding machine, broaching machine, horizontal planing machines, slotting machine, vertical shaping machine, shaping machines, gear generating machine, bevel gear cutting machine, thread milling machine, band saw, vertical grinder, double-headed disc grinder, cylindrical grinder, boring and facing machine, vacuum cleaning plant.

Brass Finishers' Shop.—Brass finisher's turret lathe, brass finishers' surfacing and boring lathe, duplex cock turning lathe, screw cutting lathe, grinding machine, high speed shaper, boring and facing machine, horizontal drilling machine, condenser ferrule making machine, double-headed disc grinders, ribbon grinder, automatic screwing machine.

Tool Shop.—Sliding, surfacing and screw cutting lathes, high class horizontal planing machine, universal milling machine, die sinker, high class shaping machine, radial drill, thread milling machine, grinding machine, hydraulic press, hydraulic vertical plate bending machine, hydraulic riveting machine, hydraulic joggling machine, high speed friction saw, hydraulic portable riveting machine, manhole cutting machine, large hydraulic press, set rolls, multiple spindle drilling machine.

Bolt Shop.—Automatic screwing machines drop hammer, nut facing machine, multiple head tapping machine, hot press nut machine.

Turbine Shop.—(Blading Room).—Packing piece cutting-off machine, blade tipping machine, horizontal multiple-blade drilling machine.

Coppersmith Shop.—Pipe screwing machines, pipe bending machine, punching and shearing machine, circular saw, hack saw.

Pattern Shop.—Disc grinder.

Electrical Shop.—3½-inch lathe, 6-inch lathe, pipe-cutting machine, shaping machine, pipe screwing machine, combined wet and dry grinding machine, punching and shearing machine, radial drilling machine, universal milling machine, coil winding machine, armature coil taping machine, vacuum drying and impregnating plant.

Platers' Shop.—Hydraulic joggling machine, hydraulic manhole punching machine, notching machines, double punching machines with side shears, bulb angle and double bar shear and beam bending machine, plate slitting shears, band saw, plate straightening rolls, horizontal drills, punching and shearing machines, double tool grinders, pneumatic hammer, bevelling machine, hydraulic frame benders, punching and shearing machines, radial countersink drilling machines, bulb angle and double bar shears and beam bending machine, plate slitting shears, horizontal drills, band saw, plate bending rolls, manhole punch, plate joggling machine, plate flanging machine.

Fitting Shop.— Planing machines, slotting machine, double-headed shaping machine, universal miller, high speed sensitive pin drills, high speed boring and surfacing machines, high speed radial drilling machines, variable speed combination turret lathe, variable speed hexagon turret lathe, variable speed gap lathe, hollow spindle friction capstan lathe, variable speed hollow spindle flat turret lathe, double grinder, side disc grinder, band saw.

Plumbers' Shop.—Single head pipe screwing machines, pipe flange face grinder.

Joiners' Shop. — Automatic knife grinding machine, pendulum saw, Perkins or other hand trimmer, planing machine.

Shipwrights' Shop.— Electric deck planing machine, planing machine, boring machine, steam hammers, steam hammer, steam olivers, forge steam hammer.

Tenders should be addressed to the Director of Navy Contracts, Navy Office, Melbourne, Australia. The departure of mails, by which tenders can be submitted within the contract time, from San Francisco and Vancouver, are as follows:—From San Francisco, September 28, due at Melbourne October 19; from Vancouver, September 29, due at Melbourne October 23. There is no duty on naval supplies.

Tenders for the various items close at Melbourne on October 25, 1915.

EMERY FACED WHEELS FOR POLISHING SHRAPNEL SHELLS.

IN a recent article in the Brass World, James Haslip makes some pertinent remarks regarding the care and preparation of wheels which are at present being widely used by shrapnel makers to polish the spots where the hardness of the shell has to be tested:—

"The glue room should be separate and especially arranged, drafts from windows and doors being avoided so that the thin layer of glue will not chill on application to the wheels. Glue of any kind should be soaked in cold water several hours before heating. Being of animal matter, it is quickly decomposed by heat if soaked in hot water, and its strength impaired. Glue should never be boiled after being soaked and heated; no further melting is necessary It should be kept constantly at a temperature not exceeding 160 deg. Fahr. The glue pots should be thoroughly cleaned before refitting, no scum being allowed to accumulate. . . . . No glue should be used the second day as the strength will be impaired about 50 per cent. by standing over night, and thickened glue diluted, never has its original strength.

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INDUSTRIAL PATRIOTISM!

ALL accounts regarding the production of munitions in Britain, indicate an urgency in the matter which is now far from making itself manifest in Canada. Ten months ago, the few Canadian firms who had been awarded portions of the first shell order were being pressed for delivery in a manner which was probably truly indicative of the urgency which then existed.

Happenings in Europe since that time do not indicate any decrease in the urgency, but the present condition of the shell industry in Canada does not coincide with the state of affairs which obtains in England and Scotland at the moment.

Advices from England betray a feverish activity as a result of the campaign waged so effectively by the Munitions of War Minister. Four months ago Canada's efforts were approaching a degree of intensity which has only been reached in England during the last few weeks, and these efforts would have been more productive and vigorous now, had not the "fixing" bogey appeared on the horizon. While the question of fixing the ammunition is being overcome in a manner which may ultimately be satisfactory, the sudden and altogether unexpected appearance of this demand and the circumstances under which it was allowed to develop, did much to detract from the enthusiasm which was being displayed in Canadian engineering circles.

Industrial Patriotism was indeed at high tide, numbers of unemployed workers were being rushed for the first time in years, and hungry men were once more able to buy a square meal and those who could raise capital for shell making were more than willing to do so. Stagnation in various dispensable branches of business had thrown men out of work who on account of years or other physical disability, were unfitted for active service. These and many others who were unaccustomed to manual labor were therefore available for service in shell factories, and proved by their efforts that they were both actuated by a genuine desire to help their country in its hour of need, and incidentally glad to again become wage-earners.

Matters in England and Scotland have not only developed to the stage which has already been attained in Canada, but have gone to a point which we hope will never exist in this country. We refer to the labor situation. The attitude of certain workers in Britain during recent weeks will remain a most unpleasant memory in years to come.

The extent to which in time of war a man is willing to surrender his personal liberty and freedom, and devote his entire energies towards assisting his native land, is perhaps the best possible standard by which to gauge the depth of his patriotism. Measured in this light, the activity of Munitions Tribunals in all parts of Britain indicate a lack of patriotism which will give the Kaiser's satellites a further opportunity for sarcastic comment. One feature of Canada's participation in the war has been the absence of internal strife and dissension between employers and employed. Employees are entitled to all the benefits and advantages which they can obtain as a result of active organization, and they are just as much aware as any other members of civilized society that their activity in peace time is fruitful just as it may be in accord with law and the rights of others.

Every day it becomes more evident that the engineering industry is truly the Empire's Reserve. Credit, money, finance, legislation, all are of no value to a nation which cannot give concrete expression to these abstract influences. Industrial patriotism as exemplified by Canada represents the real conception of a nation's duty, and in days to come not the least of the credit will belong to those who, whether masters or men, laid self aside and despite disappointments, delays and discussions, maintained a singleness of purpose which has contributed to place Canada high in world esteem.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey Forge, Pittsburgh	.....	$14.20
Lake Superior, charcoal, Chicago	.....	16.25
Ferro Nickel pig iron (Soo)	.....	25 00

	Montreal.	Toronto.
Middlesboro, No. 3	21 00	......
Carron, special	22 00	.....
Carron, soft	22 00	.....
Cleveland, No. 3	21 00	.....
Clarence, No. 3	21 50	.....
Glengarnock	25 00	.....
Summerlee, No. 1	27 00	.....
Summerlee, No. 3.....	26 00	.....
Michigan charcoal iron.	25 00	.....
Victoria, No. 1.......	22 00	19 00
Victoria, No. 2X	21 00	19 00
Victoria, No. 2 Plain..	21 00	19 00
Hamilton, No. 1	21 00	19 00
Hamilton, No. 2	21 00	19 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	2.20
Steel bars, f.o.b., Toronto	2.20
Common bar iron, f.o.b., Montreal	2.20
Steel bars, f.o.b., Montreal	2.20
Twisted reinforcing bars	2.20
Bessemer rails, heavy, at mill....	1.25
Steel bars, Pittsburgh	1.30
Tank plates, Pittsburgh	1.30
Beams and angles, Pittsburgh....	1.30
Steel hoops, Pittsburgh	1.40
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.10
Small shapes	2.35
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.90
Structural shapes	1.95
Plates	1.95

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ¼ to ½ in., 100 lb.	$2 35	$2 25
Heads, per 100 lb.	2 55	2 45
Tank plates, 3-16 in.	2 60	2 45

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$11 00	$11 75
Copper, crucible	12 00	12 50
Copper, unch-bled, heavy	12 00	12 50
Copper, wire, unch-bled..	13 00	13 50
No. 1 machine compos'n	11 00	11 00
No. 1 compos'n turnings.	9 00	9 00
No. 1 wrought iron	6 00	6 00
Heavy melting steel	8 00	8 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings....	11 00	11 00
No. 1 brass turnings....	9 00	9 00
Heavy lead	4 50	4 75
Tea lead	$ 3 25	$ 3 50
Scrap zinc	8 50	9 00

W. I. PIPE DISCOUNTS.

Following are Toronto jobbers' discounts on pipe in effect June 25, 1915:

	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
	Standard			
¼, ⅜ in.	63	32½	....	....
½ in	68	41½	....	....
¾ to 1½ in. .	73	46½	....	....
2 in.	73	46½	69	42½
2½ to 4 in. ..	73	46½	72	45½
4½, 5, 6 in. ..	....	....	70	43½
7, 8, 10 in. ..	....	....	67	40½
	X Strong P. E.			
¼, ⅜ in.	56	32½	....	....
½ in.	63	39½	....	....
¾ to 1½ in. ..	67	43½	....	....
2, 2½, 3 in. ..	68	44½	....	....
2 in.	....	....	63	39½
2½ to 4 in. ..	....	....	63	42½
4½, 5, 6 in. ..	....	....	66	42½
7, 8 in.	....	....	59	35½
	XX Strong P. E.			
½ to 2 in.	44	20½	....	....
2½ to 6 in. ..	....	....	43	19½
7 to 8 in......	....	....	40	16½
	Genuine Wrot Iron.			
⅜ in.	57	26½	....	....
½ in.	62	35½	....	....
¾ to 1½ in. ..	67	40½	....	....
2 in.	67	40½	63	36½
2½, 3 in.	67	40½	66	39½
3½, 4 in.	....	....	66	39½
4½, 5, 6 in. ..	....	....	63	36½
7, 8 in.	....	....	60	33½

Wrought Nipples.

4 in. and under	77½%
4½ in. and larger	72½%
4 in. and under, running thread.	57½%

Standard Couplings.

4 in. and under	60%
4½ in. and larger	40%

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws....	65%
Sq. Head Set Screws	65 & 10%
Rd. & Fil. Head Cap Screws......	45%
Flat & But. Head Cap Screws....	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in. N.	70%
Semi-Fin. Nuts up to 1 in.	70%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

METALS.

	Montreal.	Toronto.
Lake copper, carload ...	$20 00	$19 00
Electrolytic copper	19 75	18 75
Castings, copper........	19 00	18 50
Tin	40 00	39 00
Spelter	18 00	16 00
Lead	6 25	6 00
Antimony	40 00	40 00
Aluminum	40 00	40 00

Prices per 100 lbs.

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh...	$22 00
Openhearth billets, Pittsburgh..	22 00
Forging billets, Pittsburgh	28 00
Wire rods, Pittsburgh	25 50

NAILS AND SPIKES.

Standard steel wire nails, base	$2 40	$2 35
Cut nails	2 50	2 70
Miscellaneous wire nails..	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	75
Stove bolts	80
Plate washers	40
Machine bolts, ⅜ and less......	70
Machine bolts, 7-16 and over....	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass.....	35 p.c.
Nuts, square, all sizes..	4¼c per lb. off
Nuts, Hexagon, all sizes.	4¾c per lb. off
Iron rivets	72½ per cent.
Boiler rivets, base, ¾-in. and larger	$3.25
Structural rivets, as above.......	3.25
Wood screws, flathead, bright	85, 10, 7½, 10 p.c. off
Wood screws, flathead, Brass	75 p.c. off
Wood screws, flathead, Bronze	70 p.c. off

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong, Sizes Ins.	Price per ft.	D. Ex. Strong, Size Ins.	Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.....
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....

COKE AND COAL.

Solvay Foundry Coke	$5.75
Connellsville Foundry Coke	4.85-5.15
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

COLD DRAWN STEEL SHAFTING.

At mill	45%
At warehouse	40%

Discounts off new list. Warehouse price at Montreal and Toronto.

MISCELLANEOUS.

Solder, half-and-half	24.75
Putty, 100-lb. drums	2.70
Red dry lead, 100-lb. kegs, per cwt.	9.67
Glue, French medal, per lb.	0.18
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.18
Benzine, single bbls., per gal.	0.18
Pure turpentine, single bbls.	0.64
Linseed oil, raw, single bbls.	0.65
Linseed oil, boiled, single bbls.	0.68
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Lead wool, per lb.	0.10
Pure Manila rope	0.16
Transmission rope, Manila	0.20
Drilling cables, Manila	0.17
Lard oil, per gal.	0.73
Union thread cutting oil	0.60
Imperial quenching oil	0.35

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto 40%

PROOF COIL CHAIN.

1/4 inch	$8.00
5-16 inch	5.35
3/8 inch	4.60
7-16 inch	4.30
1/2 inch	4.05
9-16 inch	4.05
5/8 inch	3.90
3/4 inch	3.85
7/8 inch	3.65
1 inch	3.45

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1 1/2 in.	60
Carbon over 1 1/2 in.	25
High Speed	40
Blacksmith	60
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Centre	25
Pipe Reamers	80

Discounts off standard list.

IRON PIPE FITTINGS.

Canadian malleable, 35 per cent.; cast iron, 60; standard bushings, 60; headers, 60; flanged unions, 60; malleable bushings, 60; nipples, 75; malleable, lipped unions, 65.

TAPES.

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3.50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$3 00	$2 90
Canada plates, dull, 52 sheets	3 25	3 50
Canada Plates, all bright	4 40	4 60
Apollo brand, 10 3/4 oz. galvanized	6 40	5 95
Queen's Head, 28 B.W.G.	6 00	6 25
Fleur-de-Lis, 28 B. W. G.	5 75	5 75
Gorbal's Best, No. 28	6 50	6 50
Viking metal, No. 28	6 00	6 00
Colborne Crown, No. 28	5 38	5 30

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$11 00	.....
1 1/4 in.	11 00	.....
1 1/2 in.	11 00	.....
1 3/4 in.	11 00	.....
2 in.	11 50	9 20
2 1/4 in.	13 00	.....
2 1/2 in.	14 00	12 10
3 in.	16 00	12 70
3 1/4 in.	.....	13 90
3 1/2 in.	20 00	15 00
4 in.	25 50	18 90

Prices per 100 feet, Montreal and Toronto.

WASTE.

WHITE.	Cents per lb.
XXX Extra	0 10 1/4
X Grand	0 09 3/4
XLCR	0 09 1/4
X Empire	0 08 1/2
X Press	0 07 3/4
COLORED.	
Lion	0 07 1/2
Standard	0 06 3/4
Popular	0 05 3/4
Keen	0 05 1/4
WOOL PACKING.	
Arrow	0 16
Axle	0 11
Anvil	0 08
Anchor	0 07
WASHED WIPERS.	
Select White	0 09
Mixed Colored	0 06 1/4
Dark Colored	0 05 1/4

This list subject to trade discount for quantity.

BELTING RUBBER.

Standard	50%
Best grades	30%

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50%
Standard	50 & 10%
Cut leather lacing, No. 1	$1.20
Leather in sides	1.10

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	$9.00
1/4 in.	6.25
5-16 in.	4.65
3/8 in.	4.00
7-16 in.	4.00
1/2 in.	4.00

Prices per 100 lbs.

PLATING CHEMICALS.

Acid, boracic	$ .15
Acid, hydrochloric	.05
Acid, hydrofluoric	.06
Acid, Nitric	.10
Acid, sulphuric	.05
Ammonia, aqua	.08
Ammonium carbonate	.15
Ammonium chloride	.11
Ammonium hydrosulphuret	.35
Ammonium sulphate	.07
Arsenic, white	.10
Copper sulphate	.10
Cyanide of potassium (95 to 96%)	.35
Iron perchloride	.20
Lead acetate	.16
Nickel ammonium sulphate	.10
Nickel carbonate	.50
Nickel sulphate	.20
Potassium carbonate	.40
Potassium sulphide	.30
Silver chloride (per oz.)	.65
Silver nitrate (per oz.)	.45
Sodium bisulphite	.10
Sodium carbonate crystals	.04
Sodium cyanide	.35
Sodium hydrate	.04
Sodium hyposulphite (per 100 lbs.)	3.00
Sodium phosphate	.14
Tin chloride	.45
Zinc chloride	.20
Zinc sulphate	.08

Prices Per Lb. Unless Otherwise Stated.

ANODES.

Nickel	.47 to .52
Cobalt	1.75 to 2.00
Copper	.25 to .28
Tin	.45 to .50
Silver	.55 to .60
Zinc	.30 to .33

Prices Per Lb.

PLATING SUPPLIES.

Polishing wheels, felt	1.50 to 1.75
Polishing wheels, bullneck	.80
Emery in kegs	.4 1/2 to .06
Pumice, ground	.05
Emery glue	.15 to .20
Tripoli composition	.04 to .06
Crocus composition	.04 to .06
Emery composition	.05 to .07
Rouge, silver	.25 to .50
Rouge, nickel and brass	.15 to .25

Prices Per Lb.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents

Montreal, August 23, 1915.—The general market conditions in the industrial field show little change. The demand for war munitions continues to keep a large number of manufacturing plants running at full capacity. The increasing cry for war material, especially shrapnel and high explosive shells is the means of keeping the market on edge, as many who wish to help in the production of these commodities are largely handicapped by their inability to get the required equipment.

Steel.

The steel market opened the week active and strong, with a heavy demand for steel bars and billets as the feature. Inquiries for large tonnage, particularly in the States, have recently been reported, one European nation inquiring for 200,000 tons of bar and billet stock. The price of round stock used in the production of high explosive shells has been advancing steadily and is now quoted at about $1.50 per 100 pounds above that of a few months ago. Although the tension is at present a little relieved, there are indications that further advances may shortly be realized, as many mills are working to capacity on orders booked for several months ahead.

Pig Iron.

Quotations for pig iron show no appreciable change. The demand for certain grades is somewhat improved over that of a week ago and the tendency is toward a gradual improvement generally.

Scrap Metals.

Prices on old material generally remain firm. Old copper is slightly lower than a week ago, as is also heavy lead.

Machine Tools and Supplies.

The demand for machine tools is not so evident as a few months back, although numerous inquiries are abroad for different classes of lathes. It is still practically impossible to get deliveries on certain tools, especially those required in the manufacture of shells, under eight or ten months. The situation continues to be somewhat relieved, however, by the supply of special attachments to machines already installed.

Toronto, Ont., August 26.—Business conditions generally continue to improve, large orders for war material are swelling the volume of exports and also helping to stimulate domestic trade. The remarkable increase in the export trade of Canada for the first four months of the fiscal year is shown in the returns recently published by the Department of Trade and Commerce. The exports this year increased $38,430,813 over those of the corresponding period last year, while the imports decreased $36,000,535. The significance of the figures contained in this report is in the fact that the balance of trade is becoming increasingly favorable.

The announcement, made recently, that the Dominion Government propose to offer a bounty on the production of refined zinc will stimulate this industry and help materially to ensure a supply of this metal at a reasonable price. The proposed bounty will be on a sliding scale and will not exceed two cents per pound when the standard price of zinc in London falls below $33 per short ton. This arrangement has been made primarily to ensure a sufficient supply of brass for munitions.

CANADIAN GOVERNMENT PURCHASING COMMISSION.

The following gentlemen constitute the Commission appointed to make all purchases under the Dominion $100,000,000 war appropriation:—George Gault, Winnipeg; Henry Laporte, Montreal; A. E. Kemp, Toronto. Thomas Hilliard is secretary, and the commission headquarters are at Ottawa.

Steel Market.

The steel trade continues very active on orders for war materials. The mills producing bars and forgings for shells are working to capacity and are just about keeping pace with the demand. The Steel Company of Canada, Hamilton Works, is increasing its open hearth capacity and also installing more presses for shell forgings. Prices are unchanged but very firm. The trade is enjoying a period of prosperity which seems likely to last for some time, especially with regard to exports which are developing in a satisfactory manner.

The high speed tool steel situation is causing considerable anxiety on account of the shortage of supplies and increasing demand. A company has established a plant for making tungsten powder in England but the output at present is too small to be of any appreciable help. It is reported that tungsten mines in Burma will be worked more extensively but it will take some time to overtake the demand. Prices of high-speed steel are away up and will likely advance further, although the difficulty of obtaining steel is the most serious feature.

The galvanized sheet market is weak on account of the further decline in spelter. Prices of sheets have not changed but may be reduced any time, although not to any marked extent as prices of raw materials have an upward tendency. Galvanized pipe is unchanged although quotations have a weaker tendency due to the decline in spelter.

Conditions in the steel trade in the States continue to improve and foreign buying is still increasing. Russia has placed large orders for rails with American mills and it is understood that others are pending. There is still a very heavy demand for steel rounds for shells but the mills are now so well filled up that they are not in a position to take much more work for delivery this year. The United States Steel Corporation is operating at about 90 per cent. capacity. Prices on bars and billets are very firm and have an upward tendency.

Pig Iron.

Quotations on American brands are firmer and at higher prices in some cases. Grey forge iron has again advanced and is now quoted at $14.20 Pittsburg. Quotations on Lake Superior charcoal are higher, being quoted at $16.25 Chicago. Domestic brands are unchanged.

Scrap Metals.

The market is easier for most scrap metals except heavy melting steel which has advanced to $8 on good demand. Scrap copper and lead are weaker but unchanged.

Machine Tools.

There is practically no change in the general situation. There is quite a brisk demand for new machine tools but deliveries are so backward that dealers hardly know what to do. This condition has greatly stimulated the demand for second-hand equipment and dealers in this class of machinery are doing a fine business. Makers of tools and special fixtures are also exceptionally busy.

Supplies.

Business continues very brisk in machine shop supplies for the regular lines, the demand being almost entirely from shops making shells. There are no price changes to note this week except solder, "half-and-half" which is lower on account of weakness in the tin market. "Half-and-half" is now quoted at 24¾c per pound. The turpentine market is weak and lower prices may be expected. Linseed oil is unchanged but the market continues very unsettled. An advance in waste may be announced any time but no change has been made as yet.

Combined Shrapnel and High Explosive Shell Manufacturing Plant

Staff Article

An installation such as here described puts the onus of successful production largely on the machine tool builder, and, as to how the latter has met the requirement as far as 3.3 shrapnel and high explosive shells are concerned, a careful study of the illustrations and text data will make the position clear. It will also evidence the ingenuity of the management.

THE plant here described is one of the most modern and up-to-the-minute mechanical engineering establishments in Canada. It is working night and day, producing both shrapnel and high explosive shells. Everything has been carefully planned, no detail having been overlooked in the placing of the multitude of machines required for the systematic handling of large numbers of shells. As these progress through the shop, the machines are so arranged that a minimum amount of effort is required in the removal of one series of shells from one operation to another.

Routine of Work.

The rough bars or billets enter the shop at one end and continue from one group of machines to another until they reach the other end; they are then transferred to the floor above and continue in the opposite direction until they again reach the entrance end. By this time they have been finally inspected and are ready for shipment.

Stock Yard.

The first view one gets upon entering the yard leading to the shell department, impresses the observer with the extent of the operations that must successively follow. Fig. 1 shows a view of the stock as it is received from the mill. The pile of billets to the left of the track is for the making of 3.3 shrapnel shell, and the piles of steel bars to the right are to be cut into lengths for the production of 3.3 high explosive lyddite shells; in the background is a view of the shell department building.

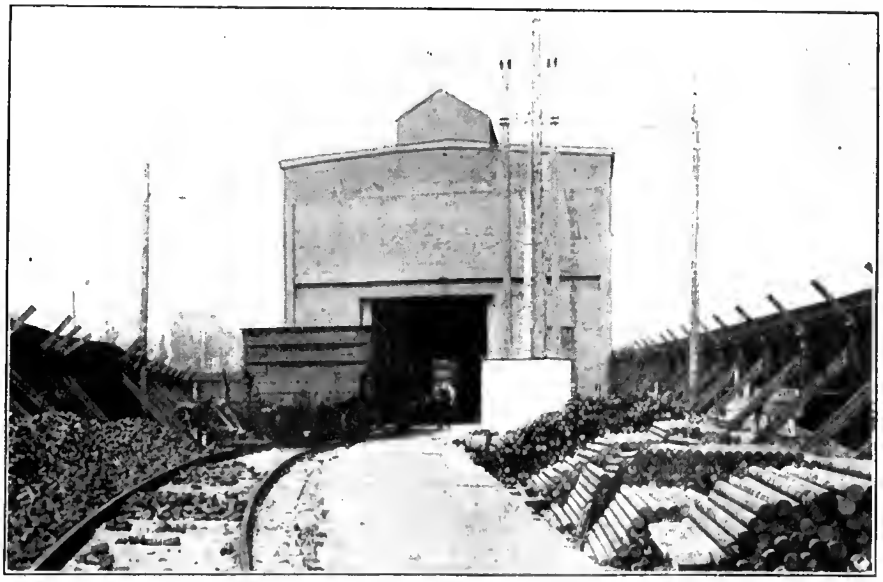


FIG. 1. VIEW OF YARD SHOWING STOCK OF SHELL BARS AND BILLETS. SHELL SHOP IN BACKGROUND

Shell Shop Features.

The shell shop was especially erected for the manufacture on a large scale of both 3.3 shrapnel and high explosive shells. The building is a two-storey steel structure 400 feet long and 50 feet wide. The ground floor is of concrete and the upper floor double boarded.

Lighting.

Light is received from a row of large windows running along both sides while, in addition the top floor is lighted by a skylight the full length of the building. Directly above the large hydraulic presses is an opening which allows a considerable amount of light to penetrate to the lower floor. Artificial light is obtained from thirty-two globes at equal intervals along both sides of the shop, each globe containing a cluster of five tungsten lamps. Each individual machine is equipped with a Wallworks, Manchester England light stand, the wires from which are placed in pipes,

and run beneath the cement floor to the walls on either side.

Heating and Fire Protection.

The building is heated by steam; pipes running along the walls on both sides the full length of the shop. It is also fully equipped against fire, being furnished throughout with a sprinkler system and "Dominion" fire extinguishers, which are placed at intervals along each wall.

Grouping of Machines.

The machines are placed in a number of groups on either side of a centre aisle, each group being driven by a 30 or 35 horse-power "Vickers" motor, the belting for same being supplied by the Beardmore Belting Co., Toronto. The machines are so arranged that the shrapnel shells progress along one side, while the high explosive shells advance along the other side.

FIG. 2. "MECHANICAL ENGINEERING CO." FURNACES FOR HEATING AND REHEATING BILLETS.

Shrapnel Shell Forging.

The shrapnel shell billets after entering the shop are taken to the three Mechanical Engineering Co. oil furnaces shown in Fig. 2, where they are heated and prepared for piercing. When ready, they are placed in one of the 250-ton Boomer & Boschert hydraulic presses shown in Fig. 3, leaving same in a shape similar to Fig. 4, and constituting the first piercing operation. The pierced billets are again heated and placed in a 200-ton B. & B. press, from which they emerge as finished forgings. A view of the drawing die is shown in Fig. 5 and the punch in Fig. 6.

The sketch Fig. 6A shows the device employed for cooling the punch. This is moved up and down around the punch while a strong stream of water is forced out of the small holes in the ring.

Cutting to Length.

After the shells are forged, they are tested for the thickness of the wall. Following this inspection, they are taken to two "Hall" cutting-off machines where the rough open end is trimmed off.

Rough Turning.

They are then centered on a jig in several Foote-Burt drilling machines after which they pass to ten C.M.C. 16 inch lathes and are rough turned over the complete surface, the mandril for driving being similar to that shown in Fig. 7. Here this plant differs somewhat from others in that the shell is rough turned to the one size its full length. The rough shell is, however, somewhat longer than otherwise, due to the required subsequent nosing operations.

Boring.

The shells are again tested for wall thickness and then taken to twelve 25-inch C.M.C. turret lathes where the powder recess is finished. The base is next finished on four "Hall" cutting-off machines.

Bottling.

The shells are now gathered into groups of 120 each, and are taken to the bottling presses in readiness for forming the nose. It might be stated that the hardening of the shells customary in most plants is dispensed with here as the nature of the steel as it comes to the shop and after drawing leaves the shell of the proper hardness. This is the only plant in Canada using 75 per cent. carbon steel. The latter is somewhat harder to work, but by using "Double Mushet" tool steel this disadvantage has been much minimized, an average of 45 shells being rough turned in ten hours with very little touching-up of the cutting tools.

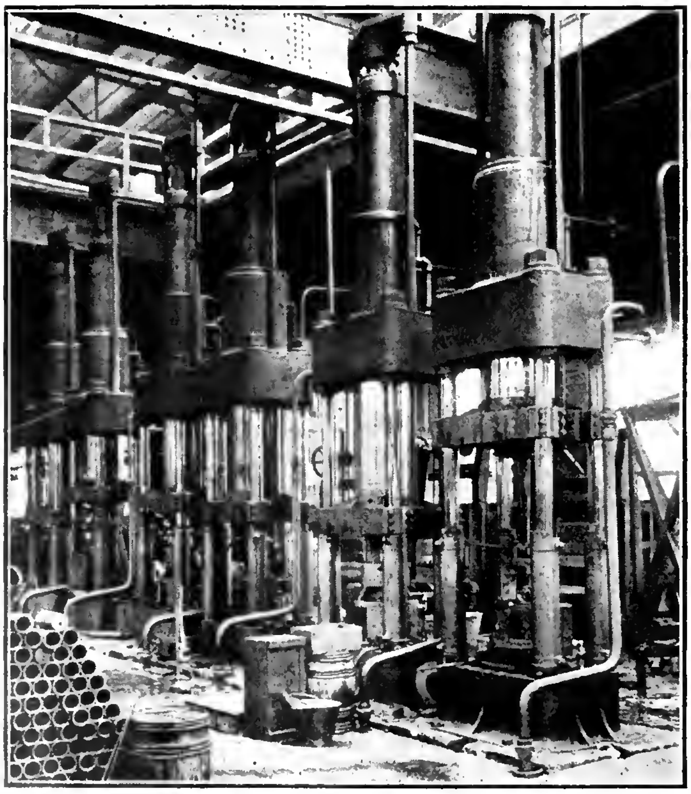


FIG. 3. THREE EACH, 250-TON "BOOMER & BOSCHERT" PIERCING AND DRAWING PRESSES.

The nosing or bottling is done in two operations, and the dies are so constructed that after the second operation the shape is almost the desired form, and requires very little machining. The dies for the two operations are shown in Figs. 8 and 9. When heating for the first operation, the open end of the shells in sets of four are placed in a vertical position in openings at the top of a "Mechanical Engineering Co." oil furnace, arrangements being made to revolve the shell while being heated. The first operation requires heating of about 2 inches or more back from the open end, and after the first process the nose is again heated in another M.E. furnace for a distance back of about ¾ of an inch, the nose being finished in the die shown in Fig. 9.

Water-Cooled Oil Furnaces.

All these oil furnaces are water-cooled, each having a water chamber between the fire-brick and the outside casing. After the bottling operation is completed, the noses of the shells are annealed for further machining.

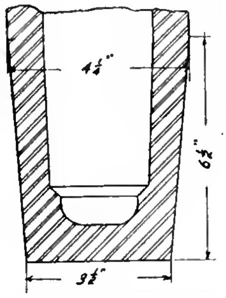


FIG. 4. SHRAPNEL BILLET AFTER FIRST DRAWING OPERATION.

Finishing and Threading Nose.

The shells are next taken to eight-16 inch. "C.M.C." lathes, fitted with turret heads and carrying a special chuck similar to Fig. 10. Thirty or forty of these chucks are in continual use. After the machining is done on the nose of the shell they go to two "Lees-Bradner" machines, where the thread in the nose is milled out. A view of these machines is shown in Fig. 11.

Finish Turning.

When threaded they are then finish-turned and the contour of nose formed by means of a fixed templet at the back of the lathe which takes care of the lateral movement of the tool-post rest.

Waving and Grooving.

The shells are now taken to five 16-inch "C.M.C." lathes, where they are held in a chuck similar to Fig. 10, and have the groove roughed out. They are afterwards taken to five 16-inch "C.M.C." lathes to have the waving and undercutting performed by means of a "Bertram" waving attachment. On account of the nature of the steel the roughing and finishing are done on separate lathes to save the cutting tools.

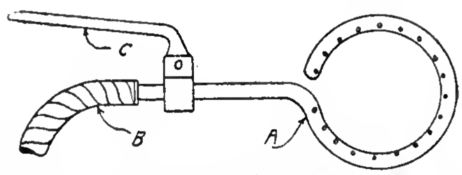
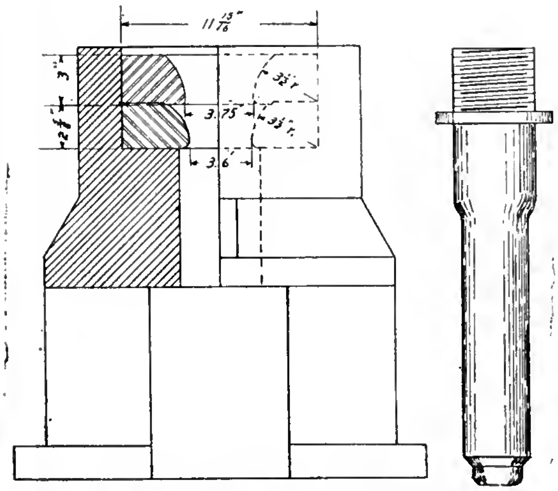


FIG. 6A. DEVICE FOR COOLING PUNCH OF FORGING PRESSES.

Final Operations.

The foregoing completes the operations as performed on the ground floor. The shells are therefore transferred by means of "Chapman" and "Cowan" elevating trucks to an "Otis-Fensom" hoist and raised to the upper floor where they are filled with shot and resin and have the final operations completed. They are finally lowered on another hoist, ready for shipment.



FIGS. 5 AND 6. DRAWING DIE AND PUNCH FOR FINISHED SHRAPNEL FORGING.

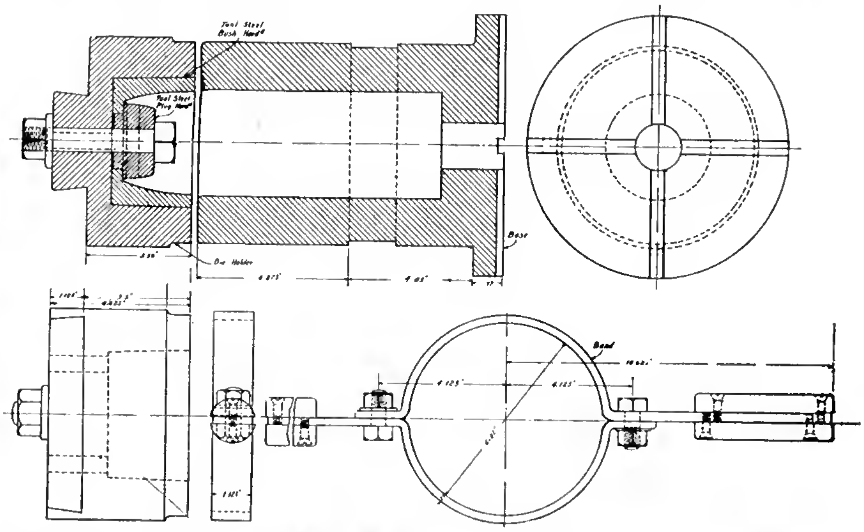
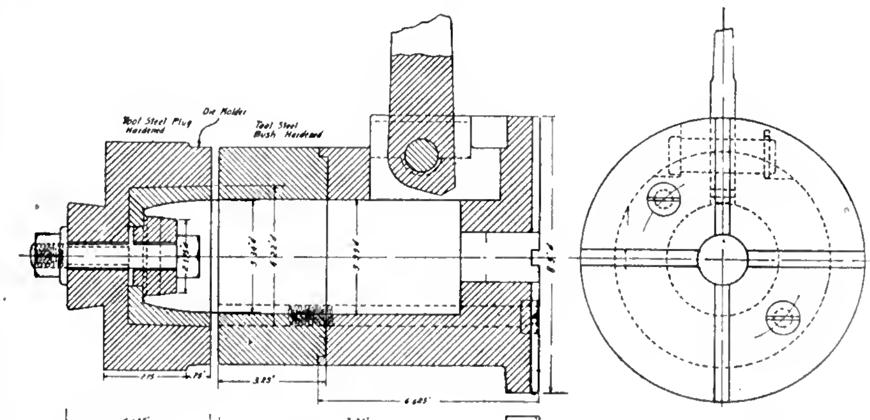


FIG. 8. DIES FOR FORMING SHRAPNEL SHELL NOSE—FIRST OPERATION.



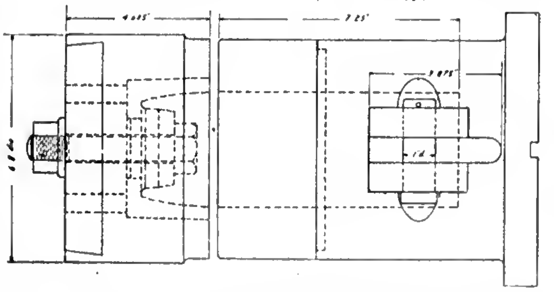


FIG. 9. DIES FOR FORMING SHRAPNEL SHELL NOSE—SECOND OPERATION.

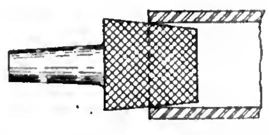


FIG. 7. DRIVING MANDRIL FOR ROUGH TURNING SHRAPNEL FORGINGS.

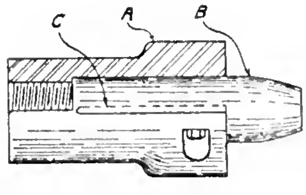


FIG. 10. SPECIAL GENERAL PURPOSE CHUCK.

A general view of shell shop with its multitude of tools is shown in Fig. 20, which is the illustration used in the title of our article.

High Explosive Shell Production.

The material for the production of 3.3 high explosive shells comes to the plant from the mill in bars as shown to the right of Fig. 1. These bars are brought into the shell shop and are first

cut into billets on an "Espen-Lucas" inserted tooth cold saw, driven by a 15 h.p. "Vickers" motor.

Rough Drilling.

The billets are placed in a jig and drilled in a battery of six "Foote-Burt" drilling machines, the drills used being furnished by the Celfor Tool Co., and the Jno. Morrow Co. After they are

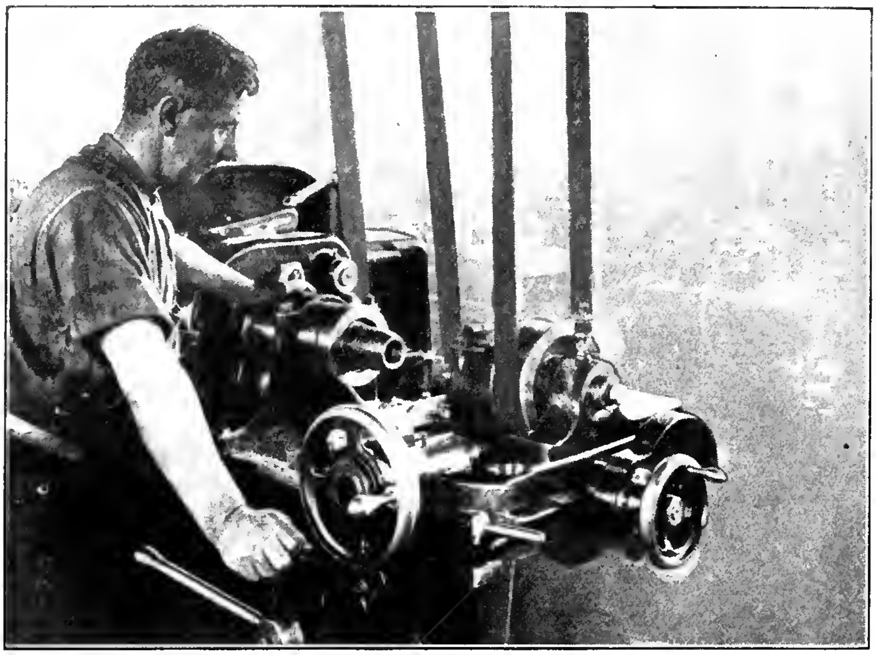


FIG. 11. THREADING NOSE OF HIGH EXPLOSIVE AND SHRAPNEL SHELLS ON A "LEES-BRADNER" THREADING MACHINE.

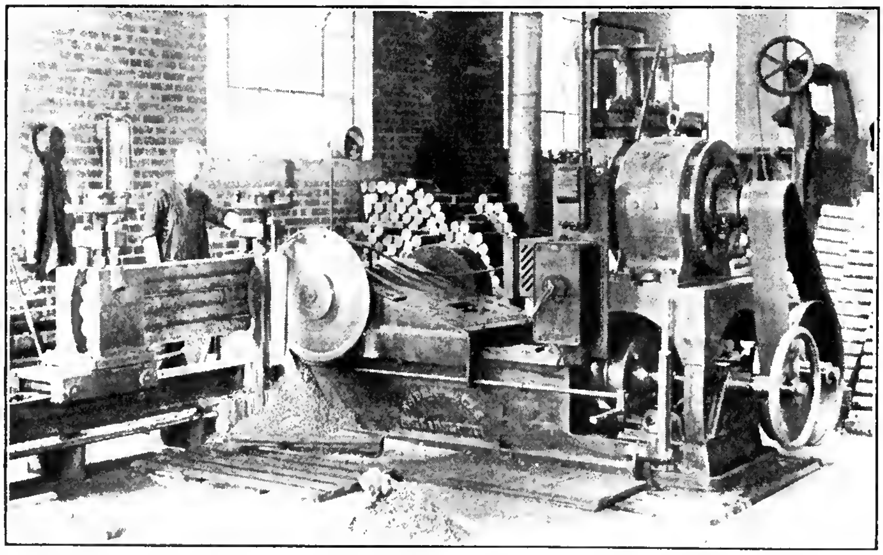


FIG. 12. "ESPEN-LUCAS" COLD SAW CUTTING-OFF BILLETS FOR 3.3 H. E. SHELLS.

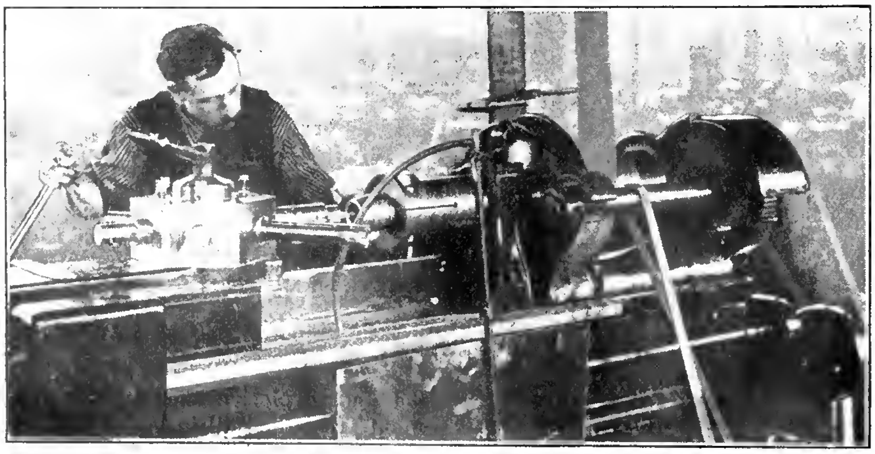


FIG. 15. TURRET OPERATIONS ON NOSE OF 3.3 HIGH EXPLOSIVE SHELLS.

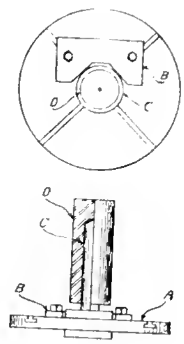


FIG. 13. CENTERING JIG.

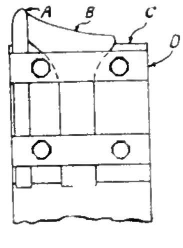


FIG. 14. NOSE FORMING TOOL.

rough drilled they are placed on a jig similar to Fig. 13 and centered.

Rough Turning and Boring.

The billets are then taken to eight 16-inch "C.M.C." lathes to be rough turned and have the contour of the shell nose formed by tools shown in Fig. 14; the tool A is for roughing, and tool B

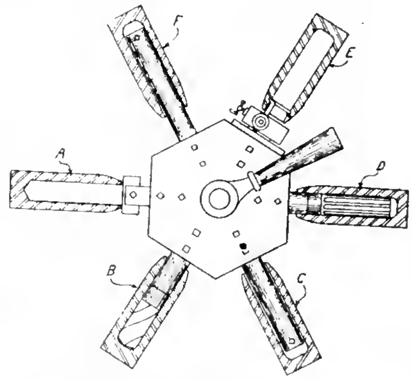


FIG. 15A. TURRET LAYOUT FOR FACING NOSE AND FINISHING INSIDE OF SHELL.

for finishing, the profile of nose. The shells are next taken to six "C.M.C." lathes fitted with turrets, and on these the boring and finishing of the inside of the nose is performed as shown in Fig. 15. The cycle of operations is shown in Fig. 15 A, and consists of facing, drilling, roughing powder chamber, reaming, recessing at bottom of thread, and finishing powder chamber.

Threading and Finish Turning.

The threading of the nose is done on

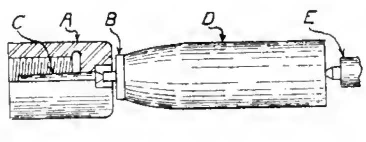


FIG 16. DRIVING CHUCK FOR FINISH TURNING.

two "Lees-Bradner threading machines as shown in Fig. 11. The shells are then finish-turned on six "C.M.C." lathes, the driving being done by means of the chuck shown in Fig. 16. Grooving and waving are performed on six

"CMC" lathes fitted with a "Bertram" waving attachment.

Finishing Nose and Base.

Finishing the nose to receive the brass sockets is done on four R. McDougal Co.

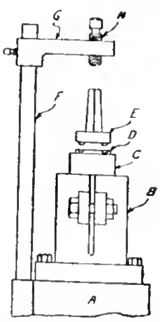


FIG. 18. JIG FOR SCREWING IN STEEL BASE PLATES.

18-in. lathes. The turret operation on the base of the shell to receive the steel disc is indicated in Fig. 17.

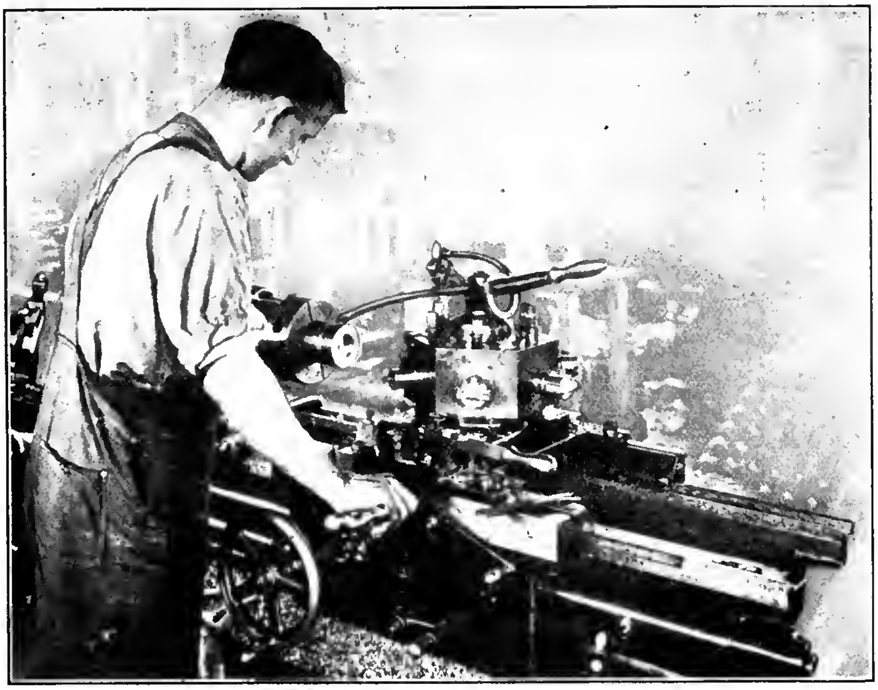


FIG. 17. FINISHING BASE OF HIGH EXPLOSIVE SHELLS ON "McDOUGALL" LATHE FITTED WITH TURRET HEAD.

Drilling and Tapping Nose.

The shells are now carried on "Chapman" and "Cowan" elevating trucks to the hoist where they are removed to the second storey. The grub screw holes are drilled and tapped in the nose and a finishing tap is run into the latter to bring the thread to the required size. The copper bands are next pressed on with a pressure of 700 to 800 lbs. per sq. in.

Screwing in Base Plates.

The steel base plates are screwed tightly in by means of the jig shown in Fig. 18. Two ½ inch holes are drilled diametrically opposite, flat bottomed and about 3-32 in. deep, so that they will be completely removed when plug is turned off flush. The stand A is firmly secured to the floor and the chuck B is bolted to the base. The shell C is rigidly clamped in piece B and the plug entered in its place; the support G for the ratchet is fastened to the piece E; the piece E having a shank which fits the socket of the ratchet and also fits the holes in the disc.

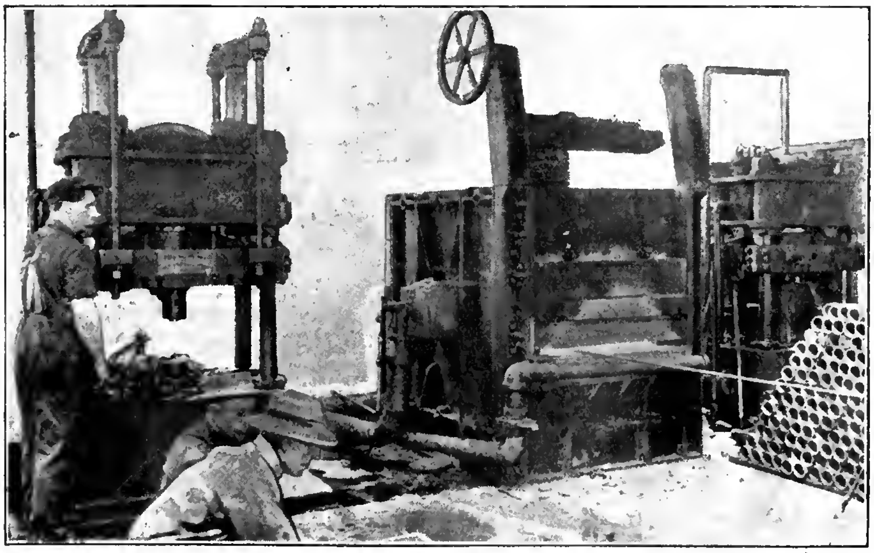


FIG. 21. "MECHANICAL ENGINEERING CO." OIL FURNACE AND "BOOMER & BOSCHERT" PRESSES FOR PRODUCING SHRAPNEL SHELL DIAPHRAGMS.

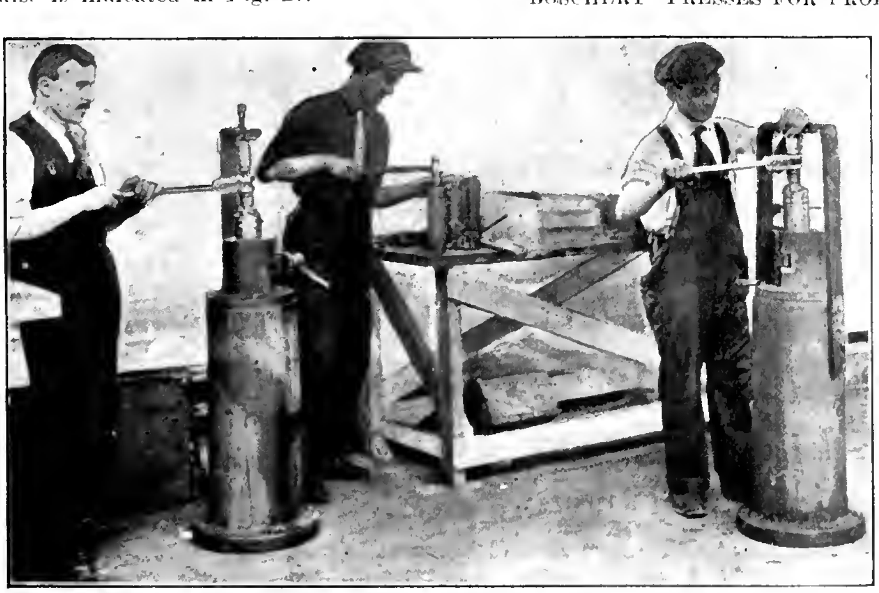


FIG. 19. SCREWING AND RIVETING REINFORCING DISCS INTO BASES OF HIGH EXPLOSIVE SHELLS.

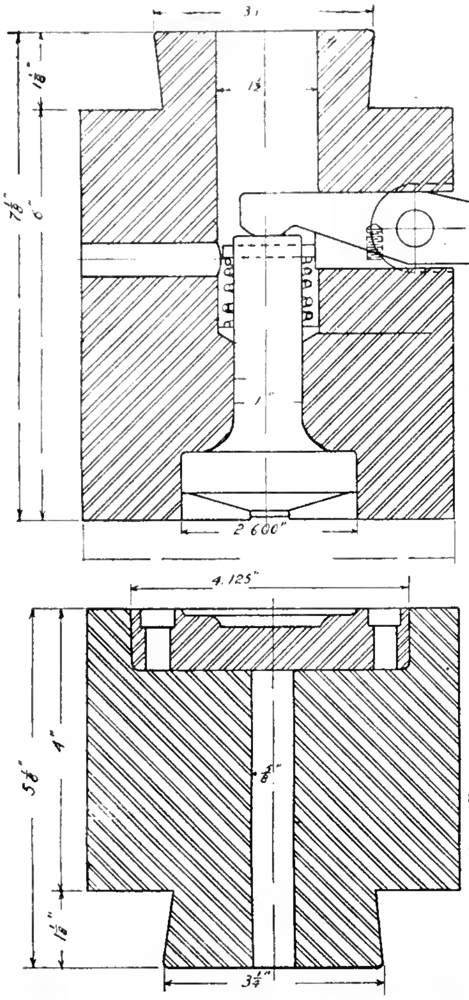
This arrangement can be made much more rigid by bridging the support as shown in Fig. 19. After the discs are screwed home, they are riveted in as shown in the centre of Fig. 19.

Finishing Base.

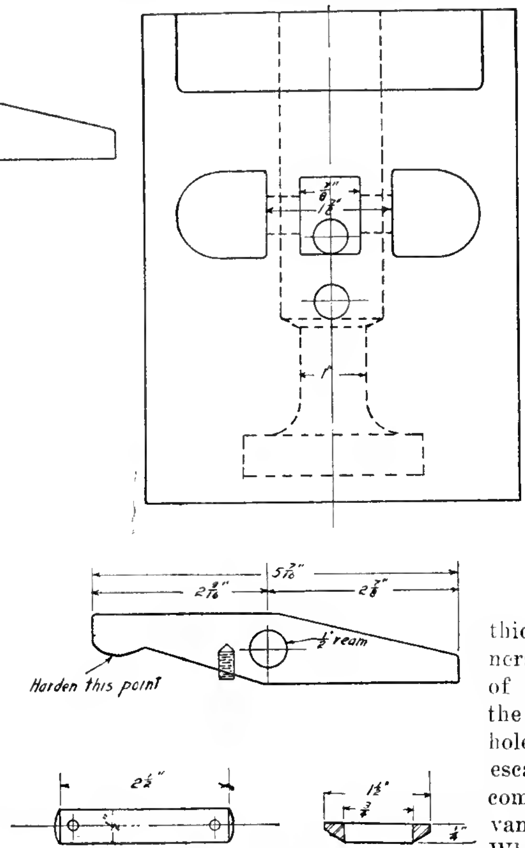
The projecting ends of the plugs are afterwards faced off on fifteen "Hall" cutting-off machines, these tools being specially adapted to this particular work.

Baking and Varnishing.

After the shells have been machined and inspected, they are ready for baking and varnishing. This operation is shown in Fig. 23. In the foreground is seen the arrangement for cleaning out the interior by means of a strong blast of air. The shells are next placed upon the hot plate shown in the background,



where they are heated to a temperature of about 400° F. The layout of this device is shown in Fig. 24. A steel plate, 7/8 of an inch thick by 4ft. by 7 ft., rests upon a wooden framework which is covered with asbestos of about ½ inch in



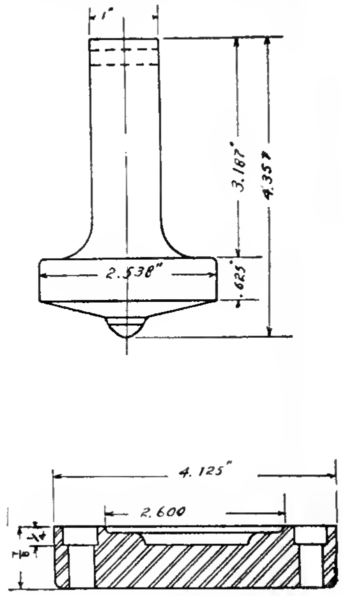


FIG. 21A. DIE BLOCKS AND DIES WITH "KICKER" FOR FORGING 18-PDR. SHRAPNEL DIAPHRAGMS.

thickness to keep the heat of the burners from attacking the wood. A row of six pipes extends the full length of the plate which is perforated with small holes from which the gas is allowed to escape and burn. As indicated the complete apparatus is covered with galvanized iron to protect the workmen. When the shell has reached the required heat, the man to the right fills the shell with varnish and then empties it into

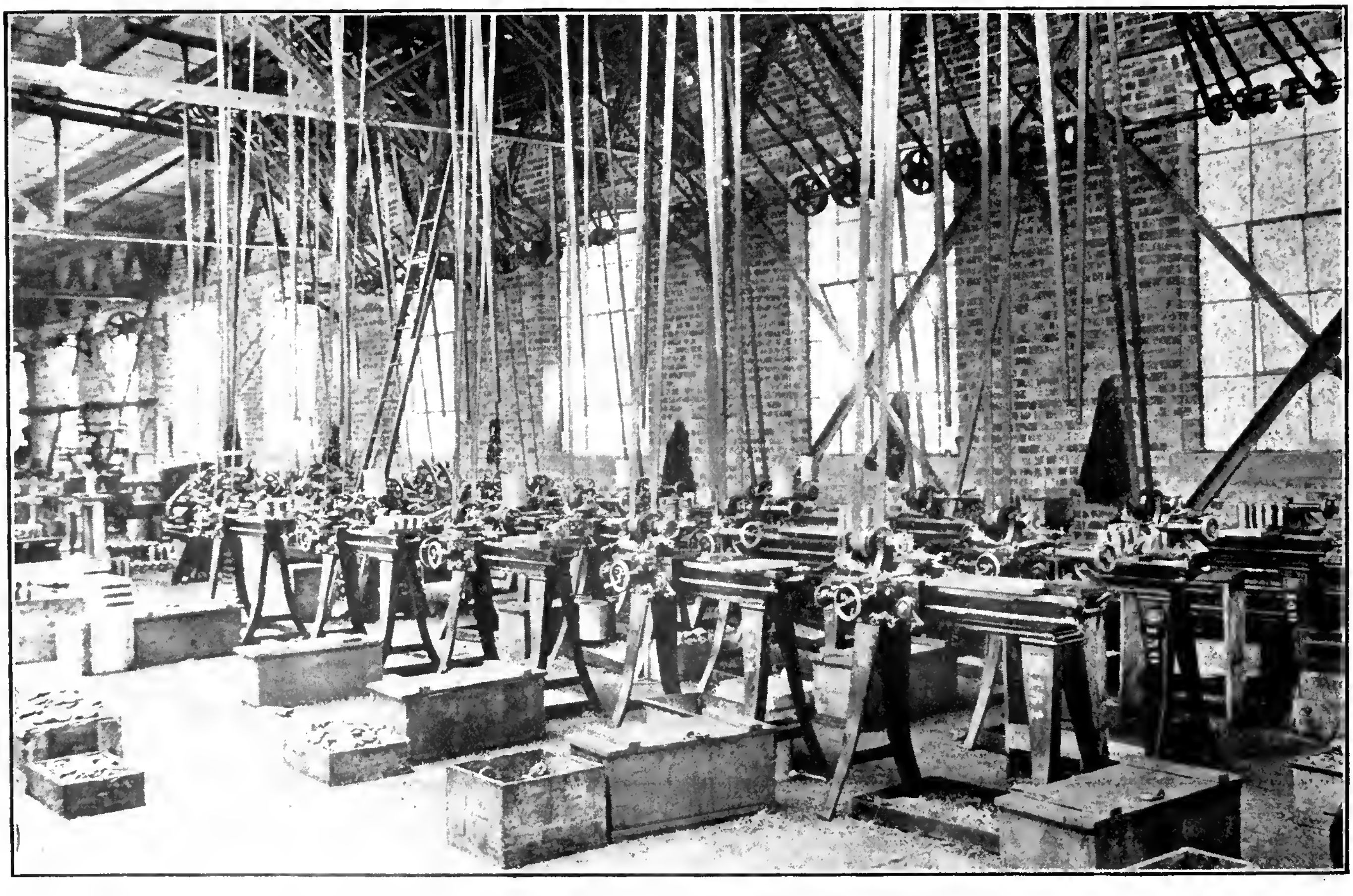


FIG. 22. GROUP OF LATHES TURNING DIAPHRAGMS FOR 3.3 SHRAPNEL SHELLS.

the next shell to be varnished, sufficient varnish adhering to the interior to leave the required coating. Heat drying immediately follows. A thin shell piece screwed into the nose serves to protect the thread from the varnish.

FIG. 23. AIR BLAST, BAKING AND VARNISHING.

Painting.

The painting is done as shown in Fig. 25, four shells being revolved in the one jig as the painting progresses. Fig. 26 shows the revolving arrangement. The shells C are placed on the piece B, this having a stem passing through the piece A which is secured to the bench. Attached to the bottom of each stem is the gear E which meshes with the intermediate gears F. Connected to the center shaft is an ordinary air motor which is supported in position by the cross piece of wood H. The same arrangement applies to the painting of the 3.3 shrapnel shells.

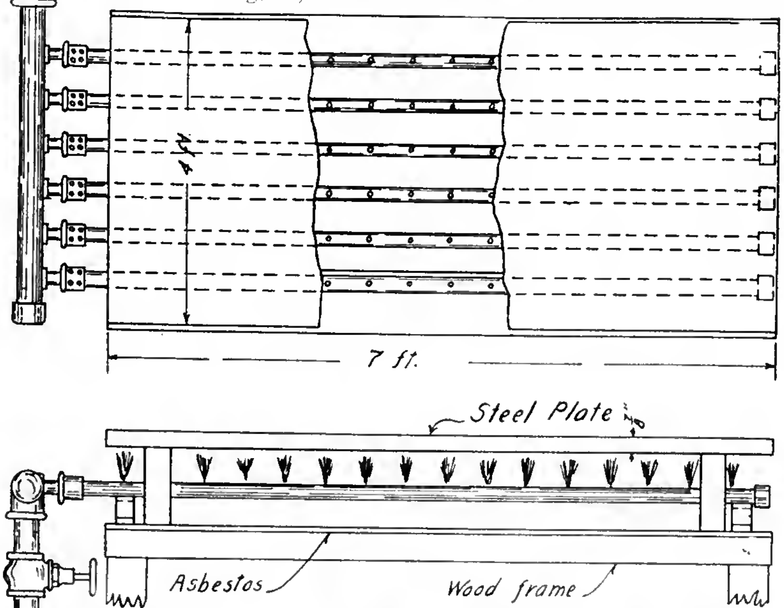


FIG. 24. HOT PLATE FOR VARNISHING.

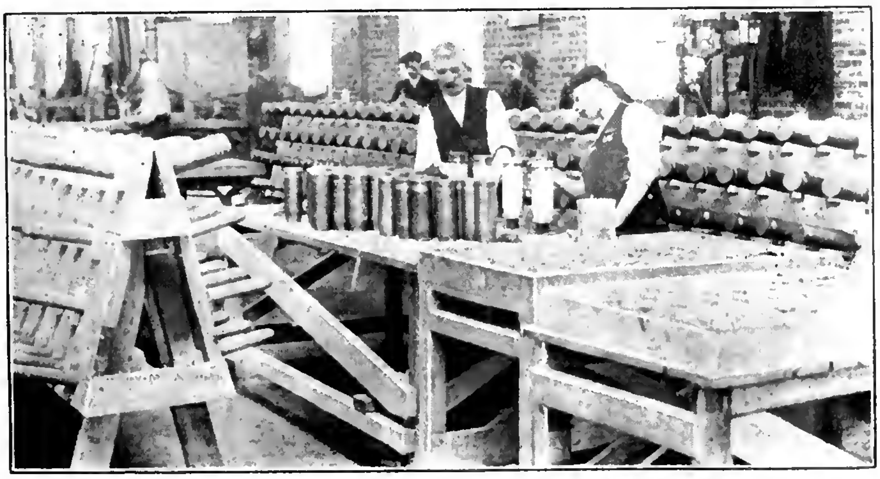


FIG. 25. PAINTING THE FINISHED SHELLS.

Shrapnel Shell Diaphragms.

The production of the diaphragm discs, which are placed inside shrapnel shells before the nose is formed, is one of the interesting features in connection with the manufacture of these projectiles. Punchings of 7-16 inch steel plate are forged to the desired shape and machined to fit the recess in the finished shell.

The punchings are placed in the Mechanical Engineering Co. oil furnace, shown in Fig. 21, and are heated and forged in the two Boomer & Boschert presses shown to the right and left of the furnace. A sketch of the forging die is shown in Fig. 21A. After being forged, they are taken upstairs and finished to the desired shape in the machines shown in Fig. 22.

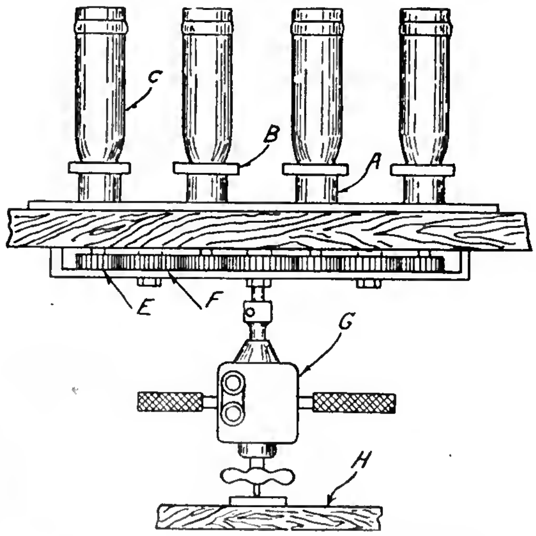


FIG. 26. PAINTING ARRANGEMENT.

When this plant is fully equipped an output of 5,000 each of 3.3 shrapnel and high explosive shells per week is expected.

The conversion of shipbuilding and marine engineering shops into shell factories proceeds apace in Great Britain, and still the demand for munitions exceeds the output. It is stated in this connection that for every soldier in the field there should be a munition worker at home, and that a battery of field artillery can use in a single day the output of 300 mechanics.

CARTRIDGE CASE COOLING CONVEYORS.

THE accompanying cuts show two special conveyors of 33 feet centres furnished by the Stephens-Adamson Mfg. Co., Aurora, Illinois, to the Metal Drawing Co., St. Catharines, Ont., for carrying red hot cartridge cases for 18-pdr. shrapnel shells from the annealing ovens to the pickling tanks prior to being re-drawn. The function of these conveyors is to afford a means whereby the cartridge cases can be cooled gradually while travelling from ovens to tanks.

Fig. 1 shows a pan of cartridge cases which have just been discharged from the annealing furnaces. These are picked off the pan singly or in pairs by means of long hand pinchers or tongs, and placed in a wire basket, which holds forty cases. The pan when empty is trucked around to the receiving end of oven ready to receive another batch of cases to be annealed. The conveyor is then put in operation and moves for a distance of two feet bringing an empty basket ready to receive its load.

Fig. 2 shows the discharge end of conveyor with basket laying in horizontal position (same as receiving end) ready for cartridge cases to be removed by hand and placed in pickling tanks for treatment.

The conveyors are spaced 14 ft. centres in line with the annealing furnaces, and between the conveyors is installed an exhauster for cooling the cartridge cases while in transit, the conveyors being started and stopped at will at either end by means of a friction clutch pulley on line shaft driving the same.

The capacity of each conveyor is approximately 1,400 shells per hour, and the time consumed between receiving and discharge end is thirty minutes, the cartridge cases emerging from conveyor thoroughly cooled. Edwin J. Banfield, Toronto, is the Ontario representative of the Stephens-Adamson Co.

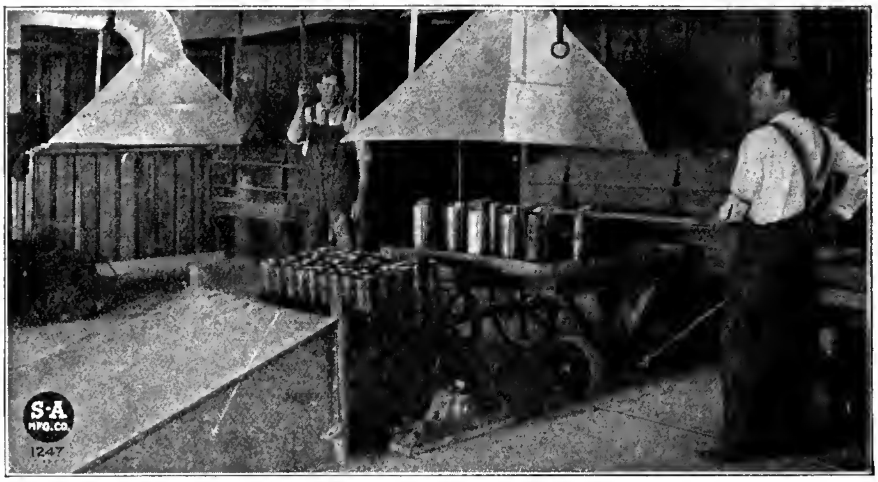


FIG. 1. CARTRIDGE CASES BEING PICKED OFF PAN FROM ANNEALING FURNACE AND LOADED INTO WIRE BASKET ON CONVEYOR.

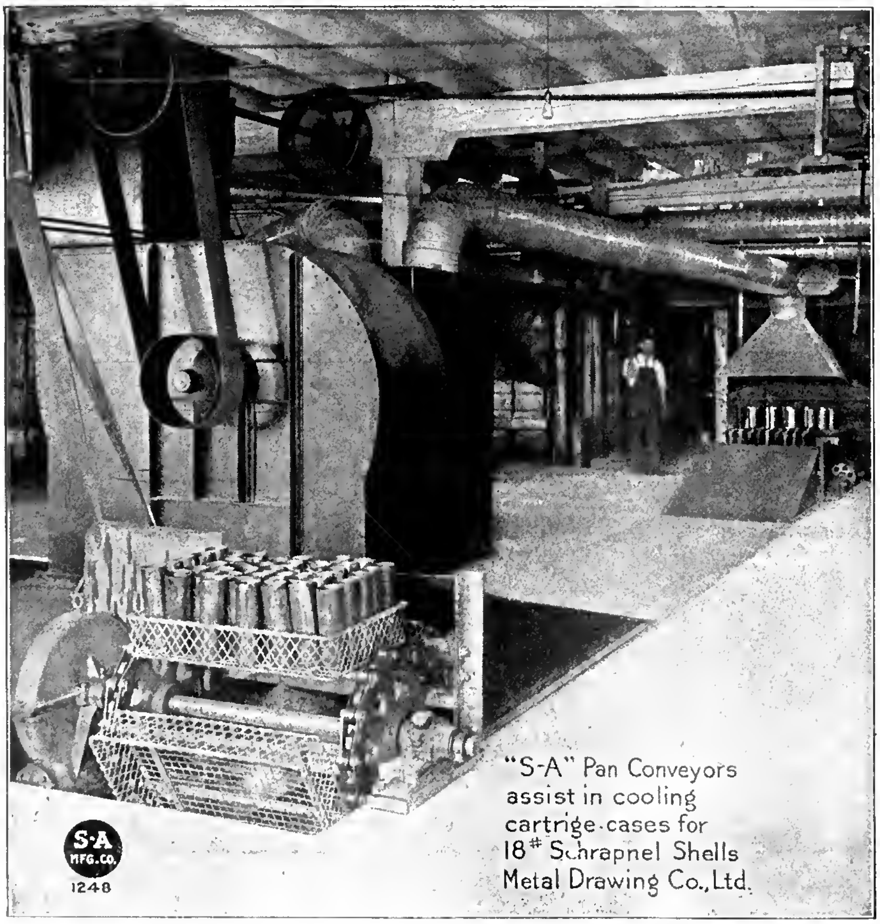


FIG. 2. DISCHARGE END OF CONVEYOR SHOWING CARTRIDGE CASES IN WIRE BASKET FOR REMOVAL TO PICKLING TANKS.

FORGING PLANT FOR 6-INCH SHELL FORGINGS.

THE cost of equipment for producing shells increases very rapidly with the size of the shell. While it is possible to extemporize to a great extent in the manufacture of 18-pdr. shrapnel and high explosive shells, the requirements of 4.5 inch shells demand more perfect machines. If the forging equipment be taken into consideration, the cost rises very rapidly. With 18-pounder shells, the forging has been done in heavy power presses or bulldozers, but 6-inch shells require a plant of a different type.

Recent estimates show that to produce 6-inch shell forgings, the following equipment is necessary. The shells are 30 inches long and the output is 30,000 per month, working 100 hours per week:

Five 450-ton vertical combined piercing and drawing presses, approximate weight 40 tons each; three 200-ton vertical cylinder pointing presses, approximate weight 8½ tons each; two 550-ton type banding presses, approximate weight 8½ tons each; three 200 brake horse-power, electrically driven, 3-throw hydraulic pumps, approximate weight 2¼ tons each; one 26-inch x 20-foot hydraulic accumulator, weight 90 tons.

A method of making a submarine periscope invisible at sea at any considerable distance is to be tested on the K. 6, now in dry dock in Brooklyn Navy Yard. The periscope has been painted in parallel stripes in various colours of the spectrum and it is calculated that the colours when refracted will be converted into a white ray.

4.5 Howitzer Shell Production in a Structural Steel Plant

Staff Article

Uncertain as to the war duration, but with the desire to bear a part in furnishing our Empire with munitions of war while maintaining its normal manufacturing equipment practically intact, the institution here described has, by the investment of a moderate amount of capital and by drawing on the skill and aptitude of its staff, succeeded in achieving a highly satisfactory degree of success in the matter of shrapnel shell quality and quantity output.

IN many cases of shell manufacture the producers were formerly engaged in branches of engineering which called for a more or less complete machine shop equipment, consequently their personnel and plant were capable of adaptation to the shell businesss, promptly and effectively.

A structural steel works such as forms the subject of this article could not be expected to enter the list of producers on equal terms with machine shop establishments. Their energies had been devoted to an entirely different class of work, involving machines, material, and operations quite foreign to the average machinist. Besides being handicapped by the nature of their previous work, they had to go into the market for tools when it was a case of taking what one could get instead of getting what one wanted.

A study of the methods and machines as developed under these conditions should be of considerable assistance to firms who are not yet advanced to the "shipping" stage. Most of our readers are now familiar with shrapnel manufacture, therefore, the points of variation will be easily noticeable.

Many special attachments are now obtainable from different machine tool builders, either for use on their own product or adaptable to any standard type of machine. It is noteworthy in the plant in question that with the exception of collapsible taps all fixtures, jigs and other appliances are the product of the shop. A consideration of the operations and the tooling equipment developed shows most creditable work by the tool room staff.

Table I. shows the sequence of operations as at present adopted.

Table I.

1—Cutting off open end only—one spur-geared constant speed cutting-off machine, built by Williams Tool Co.
2—Centering—one 10-in. single-geared drill press, built by W. F. & John Barnes.
3—Rough turn outside—one 28-in. "New Haven" engine lathe and one 28-in. "Leblond" engine lathe, both fitted with special tool equipment.
4—Rough face base—one 32-in. "American" engine lathe.
5—Bore and ream—three 24-in. "Davis" turret lathes.
6—Countersinking bevel on mouth—one 36-in. "Fosdick" radial drill.
7—Nosing—one "Hanna" pneumatic riveter.
8—Bore, face and tap nose—one 20-in. "Dreses" turret lathe.
9—Turn body and nose—one 22-in. "Hill, Clarke" engine lathe.
10—Finish internal profile of nose—one 20-in. "American" engine lathe.
11—Bore and tap recess—one "Acme" screw machine.
12—Insert plate and face-off.
13—Groove, undercut and form waved ribs—one "Whitcomb-Blaisdell" engine lathe.
14—Pressing driving bands—one three-throw "Perrin" plunger pump and banding press.
15—Turning bands—suitably equipped engine lathes.
16—Varnishing—steam-heated oven.

Reviewing the operations in rotation: The cutting off does not call for special mention, beyond the fact that the choice of a constant speed machine is justified by the small amount of tool travel due to cutting off the open end only, and leaving the facing of the base for a subsequent operation. The avoidance of friction discs and other accessories of variable speed machines is desirable in heavy work. Fig. 1 shows the detail of supporting arbor for centering shells on a small drill press. The bushing A slides on the arbor and rests on a spring B, which maintains it in a position near the top of the arbor. The spring B in turn rests upon shoulder C formed by the lower part of the arbor.

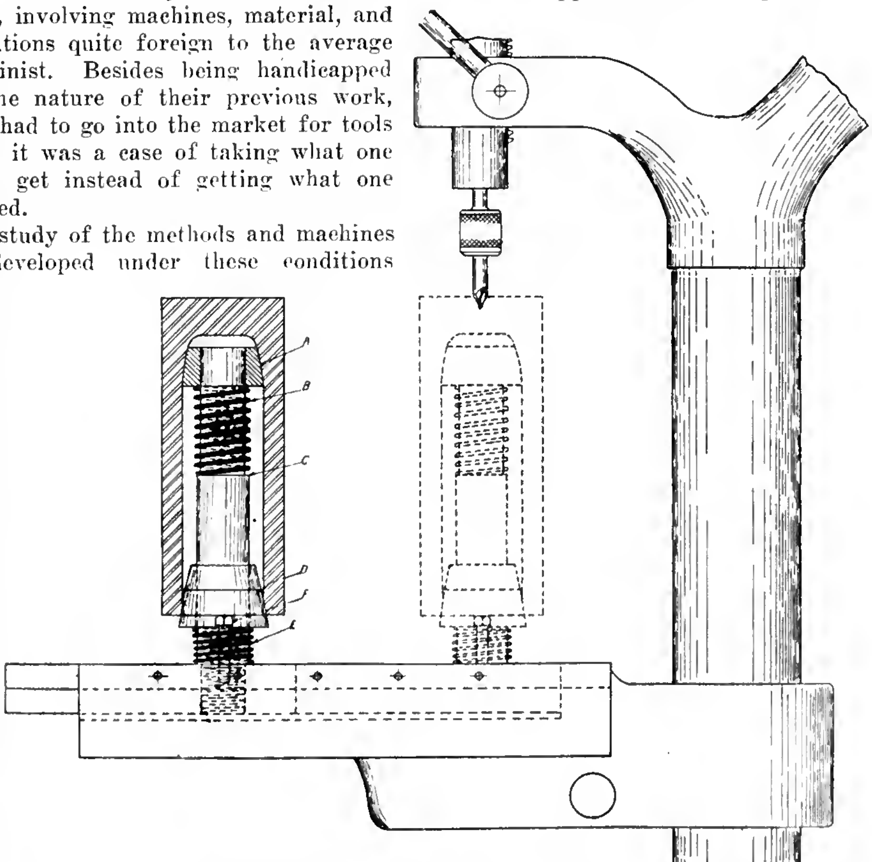


FIG. 1. CENTERING 4.5 INCH H. E. SHELL FORGINGS. DETAIL OF ARBOR.

Bushing A is made an approximate fit

for the rough bore of the forging near the base. Bushing D is a sliding fit for the lower part of the arbor, and is maintained in its highest position by spring E. Bushing D is made with a suitable taper so as to rest half way into the open end of the forging. The arbor itself is fastened to a block which slides in vees formed on the table of the drill press. When the arbor is in the outer position it is well clear of the spindle and allows the forging to be placed over it. This being done, bushing A centres itself from the rough bore near the base while the mouth of the shell is centred on conical bush D. Both of these bushings now compress the springs B and E until the weight of the forging is taken by stop pins F. By sliding the arbor to the inner position where it comes against a stop the centre of the shell is brought exactly under the centre of the drill which drills the centre hole in the usual manner.

Rough Turning.

After centering, the forgings are ready for operation (3), viz., rough turning the outside. The machines on which this is done are standard engine lathes. They are fitted with special tool boxes which carry two cutting tools spaced half the length of the shell apart from each other so that the time for the operation is halved. The tool box is of very substantial design, the tools being made of square tool steel inclined nearly to a vertical position so as to have a constant angle of clearance underneath, irrespective of the amount of top rake. The forging is driven by means of a tapered arbor with longitudinal grooves forming teeth on which the shell is driven, and held by the centre in the tail stock. This machine is shown in Fig. 2. As the amount of stock to be removed from the forging is just over one-quarter of an inch on the diameter, the capacity of these machines is limited by the ability of the tool steel to stand up under a high speed rather than by the amount of power required to remove the material. A speed of 60 feet per minute is easily maintained by the steel at present used.

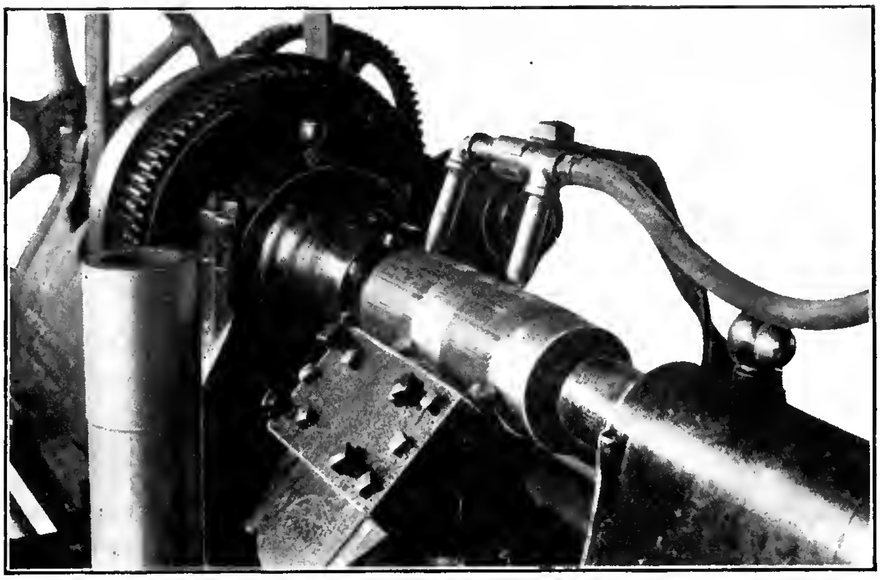


FIG. 2. ROUGH TURNING 4.5 H. E. SHELLS.

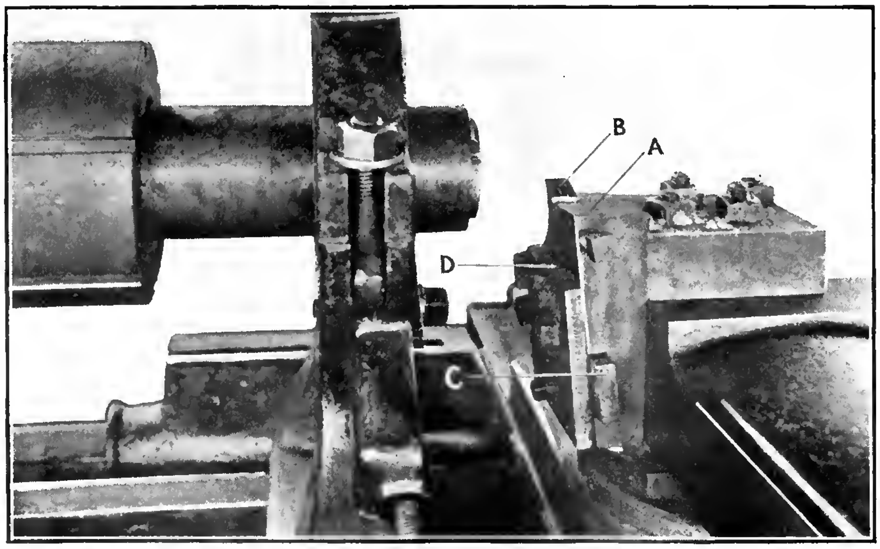


FIG. 3. OVERHUNG TOOL HOLDER FACING-OFF SHELL BASE.

The body of the rough turned shell is now of two diameters, the half of the shell next the base having just enough left on to take a final cut at a later stage, while the half next the mouth of the shell is left somewhat larger so as to have a safe margin of stock to allow for any variation in the profile of the nose after nosing-in.

The base of the shell must now be faced off to the proper thickness. Considerable variation is liable to occur in the forgings at this point, and in centering the forgings in operation (2), care must be taken to drill the center holes to a uniform depth, measured from the inside. The probability of excessive stock having to be removed at this point calls for a machine of ample capacity. The machine provided in this case is satisfactory.

An Interesting Tool Holder.

A feature of the equipment is the overhung side cutting tool holder with wedge adjustment for the cutting tool. This is clearly shown in Fig. 3. An L-shaped block is clamped on the tool box of the lathe, with one arm hanging downwards on the left side. A slot is provided in this overhanging arm to take the square tool B, which is inclined slightly from the vertical for clearance. The tool is adjusted vertically by means of the flat wedge or cotter C., the end of which can be observed in the illustration. A securely fastened side plate D holds tool and cotter in position. During this operation the shell is held in a collect chuck by the nose, while the base end revolves in the steady rest.

Boring the parallel portion of the inside, and reaming the tapering portion where the sides meet the bottom constitute the fifth operation. Heavy turret lathes are employed, having three boring bars fitted with a single cutter bar for the parallel portion of bore, and a roughing and finishing reamer for the tapered portion. The layout of the turret is shown in Fig. 4, from which it will be observed that the bars are fastened to the turret faces by flanges, into which the bars are tightly screwed and keyed. Holes on the top side of the flange communicate with a central hole which emerges at the point of the bar and allows the use of a copious supply of cutting compound at the proper point. The compound is supplied through a hose pipe with a nozzle to fit the holes in the flanges, and is changed round to each flange as its bar is brought into operation.

Impromptu Nosing Press.

A radial drill for which suitable employment had not been found was utilized for shaping the mouth of the nose preparatory to nosing. The section of the shell before and after nosing is shown in Fig. 9. The exact outline required before nosing has been the subject of considerable experiment by most makers, and the shape shown here will be useful for comparison with present and proposed outlines. The cutter is shown in Fig. 5. This is of the flat double-edged type, and is provided with a substantial pilot, which enables the full power of the drilling machine to be applied to the cutter without excessive vibration or chatter.

While to the casual observer nosing seems one of the simplest operations, there is probably a greater variety of machines used in this than in any other operation. In utilizing an existing pnuematic riveter, this firm has shown a further example of adaptation which is interesting. The machine is of the fixed horizontal gap type, with a vertical ram actuated by a compressed air cylinder operating toggle gear on the upper part of the frame. This nosing press is shown in Fig. 6, also the home-made furnace for heating the noses.

This furnace consists of an ordinary grate made of iron rods, surmounted by a semi-circular brick arch, well strapped down to the base. Three openings are provided for the graphite crucibles, which are supported on brick blocks, resting on the grate bars. A coke fire is used, which surrounds the crucibles on all sides. No chimney is required, the draft being maintained by a gentle pressure of air from the air line, the products of combustion emerging through the space around the top edge of the crucibles.

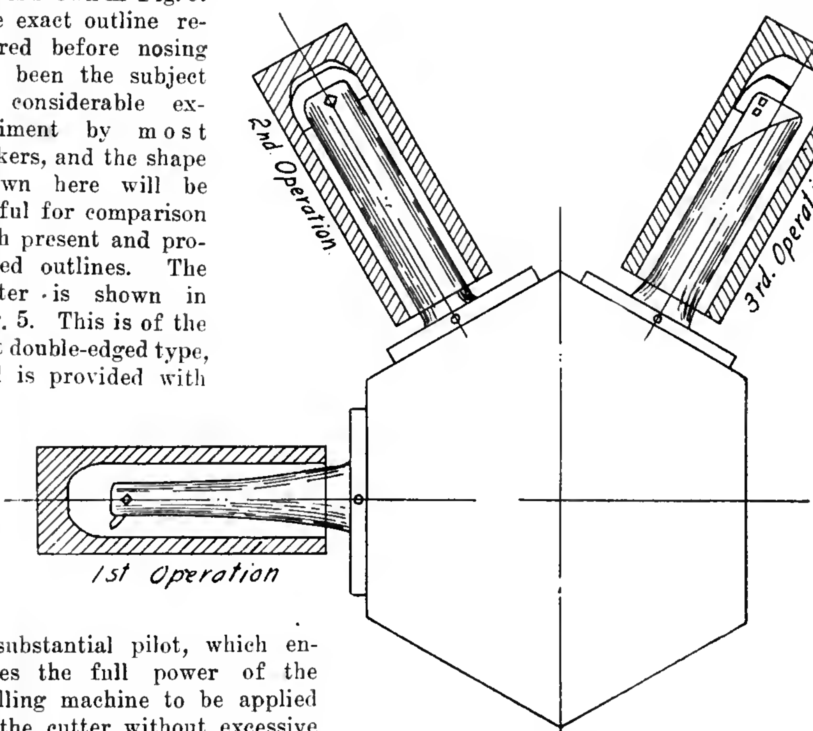


FIG. 4. LAYOUT OF TOOLS ON "DAVISS" TURRET LATHE.

Such an arrangement would be objectionable in some shops, but in a spacious well ventilated building, such as is shown here, it is quite suitable. The work is all that can be desired, the resultant hole being parallel and close to size, while the profile also approximates very closely to the finished outline. During the operation, the shell is securely held in an open-sided vise-block, with a swing gate in front, which is tightened up by a lever with a cam end on the boss.

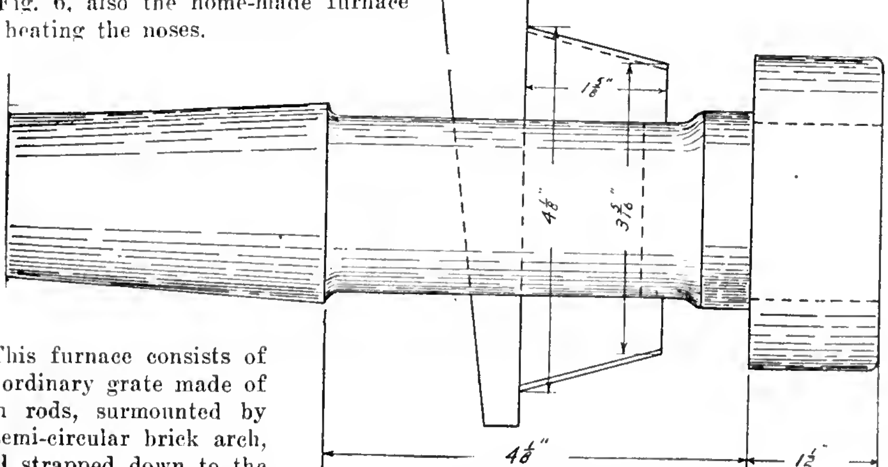


FIG. 5. CUTTER FOR BEVELLING INSIDE OF NOSE BEFORE CLOSING.

The eighth operation is performed with the shell chucked by the base and supported in a steady rest. A turret lathe is employed, two faces only being used. One is fitted with a boring bar having a cutter of suitable shape which bores the hole and faces the end of the nose. The other face of the turret carries a Murchey collapsing tap which threads the hole.

Profile Turning.

In the next operation, the shell assumes its final size and shape on the outside. The arrangement of the profiling

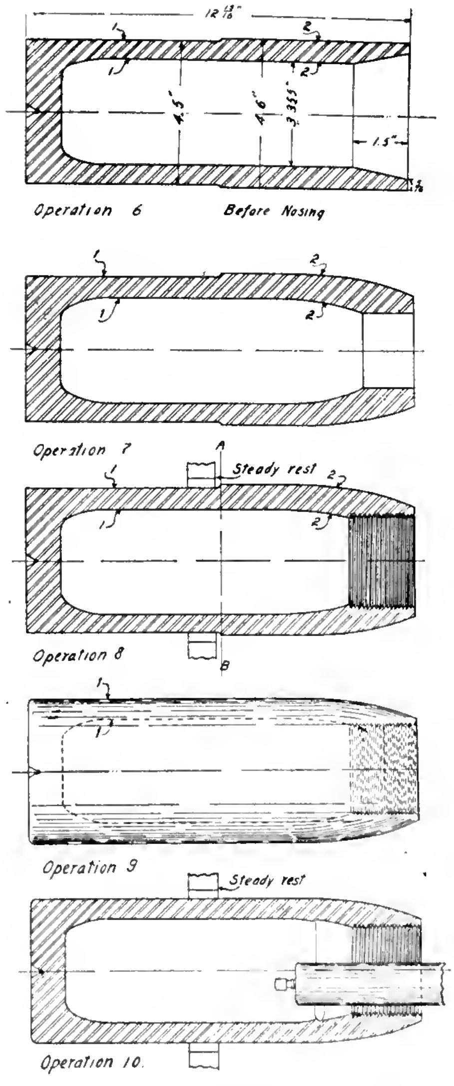


FIG. 9. ILLUSTRATING OPERATIONS 6, 7, 8, 9 AND 10.

attachment will be understood from Fig. 7. A supporting bar is fixed to two supporting blocks which are clamped over the front vees of the lathe bed at suitable points. A roller is mounted on the side of the cross slide. Two powerful springs pull the cross slide forward, and keep the roller in contact with the profile bar which is mounted on the supporting bar.

The means adopted for driving the shell is simple and efficient. At this stage of manufacture the shell has had

its overall length finally determined, the nose having been machined in relation to the base. In the operation under discussion, the shell is located by bringing the finished end of the nose in contact with a surface which has a fixed location in reference to the profile templet, so that each shell will occupy the same position in reference to the templet and insure a uniform thickness of wall in the nose.

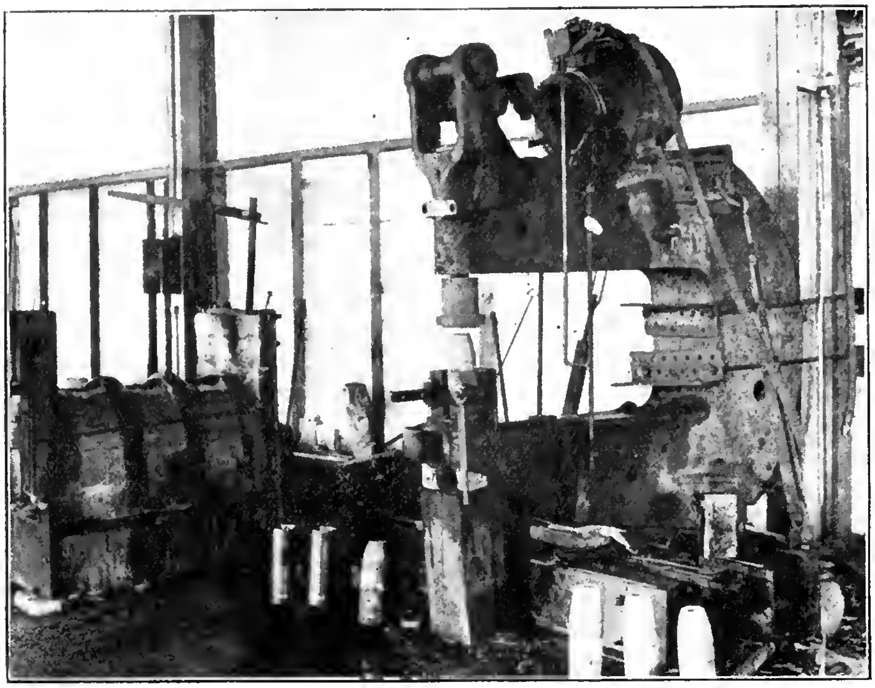


FIG. 6. PNEUMATIC RIVETER USED FOR NOSING 4.5 INCH H. E. SHELLS.

Fig. 8 shows the arrangement of driving plate and method of locating it accurately again, after it has been slackened off to allow removal of shell. A cast iron arbor, A, is threaded to fit the nose of lathe spindles. Diameter B, is machined to fit the index plate C, which carries a spring index pin or plunger D. This plate C, is secured in position by a set screw. The nose of arbor A has a left hand thread 2.6 in. diameter, which fits the threaded portion of hole in driving plate E.

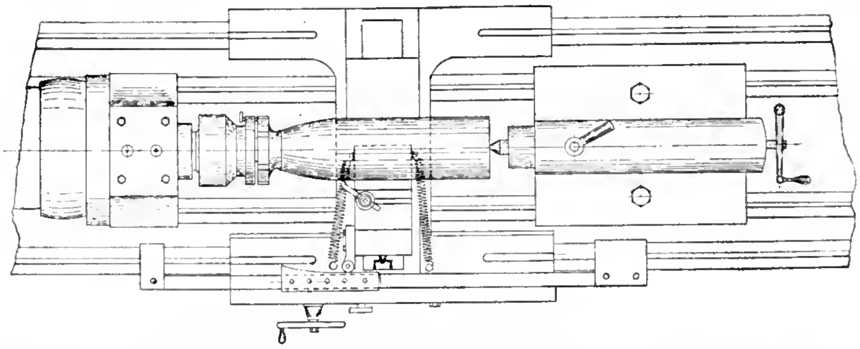


FIG. 7. PROFILE ATTACHMENT FOR TURNING OUTSIDE OF 4.5 INCH H. E. SHELL ON ENGINE LATHE.

The point of the arbor is provided with a hardened steel cap F, 2.5 in. diameter, which is threaded to fit the nose of shell. The unthreaded portion of the arbor between the left and right hand thread is made a good close fit for the unthreaded portion of hole in driving plate E.

In assembling the device, a spot is recessed on back of driving plate E. to receive plunger D. plate E being located on arbor A so that a suitable amount of right hand thread will be available for receiving the nose of shell. Index plate C is now securely fastened in place. A shell is now screwed on to the end of the arbor till it tightens up against edge of driving plate E. The left hand thread automatically locks the parts together, and any tendency of the driving plate E to revolve, simply causes the left hand thread to wedge the driving plate tighter against the nose of the shell.

When the shell has been machined, the spring plunger D, is withdrawn from the driving plate E, which is now slackened back by means of a wrench, suitable slots being provided. After the shell has been screwed off the arbor, the driving plate E is turned back to its original position and locked by plunger E, thus insuring the next shell occupying the same location in regard to the profile copy.

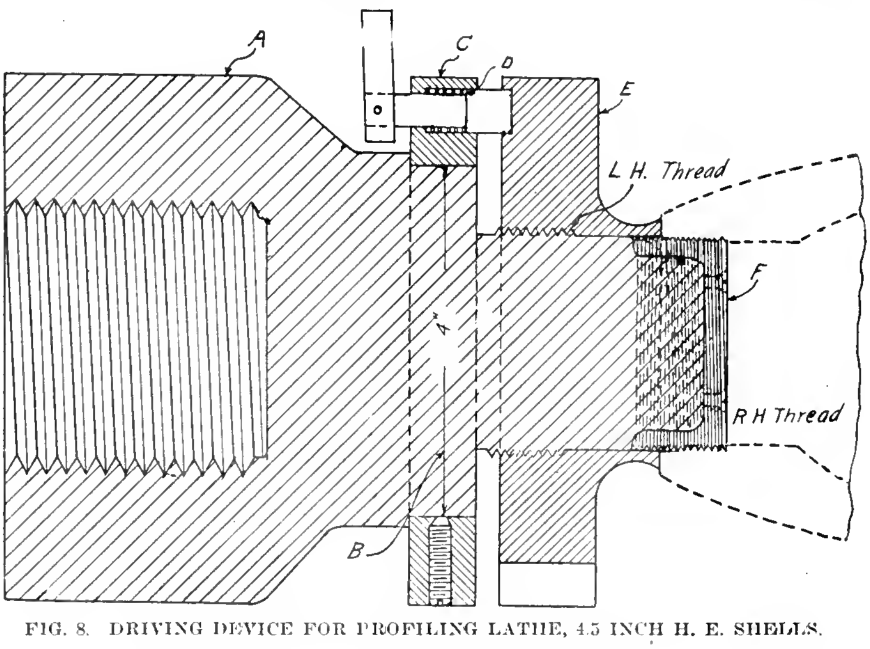


FIG. 8. DRIVING DEVICE FOR PROFILING LATHE, 4.5 INCH H. E. SHELLS.

Operation 10 consists of machining the internal profile of the nose. This is a straight-forward job due to the fact that the curve is of a single radius thereby allowing the cross slide to be connected by a radius link of the specified length to a fixed point at the rear of machine. By fixing the line of this point at the correct distance back from the nose of the shell the internal curve is reproduced.

Interdependence of Operations.

Operations 7, 8, 9 and 10 should be considered carefully because the condition of the shell after operation 10 is entirely dependent on the degree of accuracy with which the previous operations have been performed. Fig. 9 shows the shell during these operations, from which it will be observed that be-

fore nosing, surfaces (1) are concentric with each other, and also with surfaces (2). After nosing, surfaces (2) may or may not be concentric with surfaces (1), while surfaces (1) will still be concentric with each other. In operation (8), therefore, care must be taken to see that the steady rest is sufficiently far back from the beginning of the curve so that the body of the shell from the base up to line A.B. is running true.

As the bore of the shell at this point is concentric with the outside, the thread which is now formed in the nose will be concentric with the parallel part of the bore. By working with a center plug in the nose for operation (9), the outline of the body is carried forward to the end of the nose in accurate relation to the thread. Therefore, when the shell is supported on the outside for operation (10), the parallel portion of the bore will still be running true as at the start. The action of the boring cutter is now to true up the inner wall of the nose making the wall concentric and of even thickness. Unless the sequence of operations at this stage be carefully planned and accurately carried out, the resultant product may easily get out of truth with objectionable effects on the balance of the shell when fired from a gun.

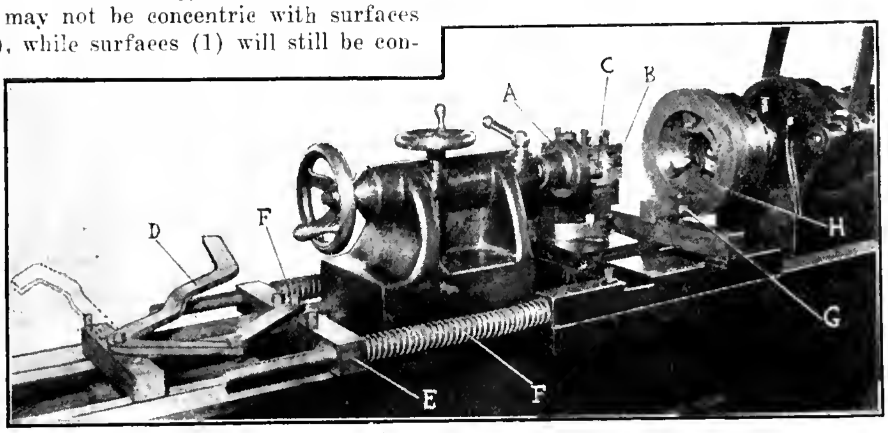


FIG. 10. WAVING EQUIPMENT ON ENGINE LATHE FOR 4.5 INCH H. E. SHELLS.

Boring and tapping the recess in the base is done on a screw machine using a collet chuck and steady rest. "Murchey" collapsing taps perform this threading job in a satisfactory manner. The plug is next tightened home, the ends of joints riveted and then faced off in the usual way.

Efficient Waving Method.

Forming the groove, undercutting the sides, and waving the threads are done in an ordinary engine lathe which has been fitted with a well-designed combination tool box, and the now familiar cam ring on the chuck. Fig. 10 gives a good idea of the substantial nature of the equipment. The base of the shell is supported in a cup centre A, and is driven by a plug center, in the nose-end.

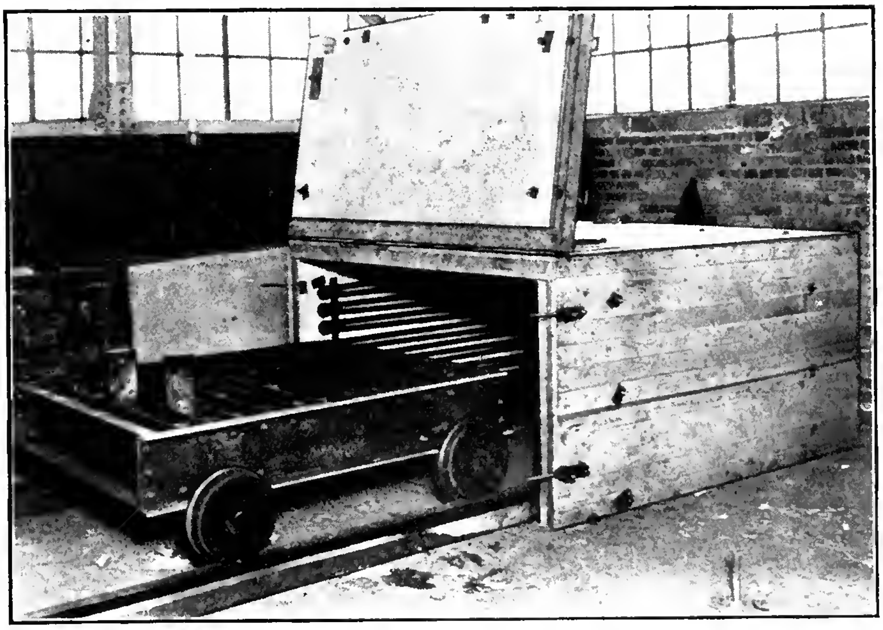


FIG. 11. STEAM HEATED BAKING OVEN.

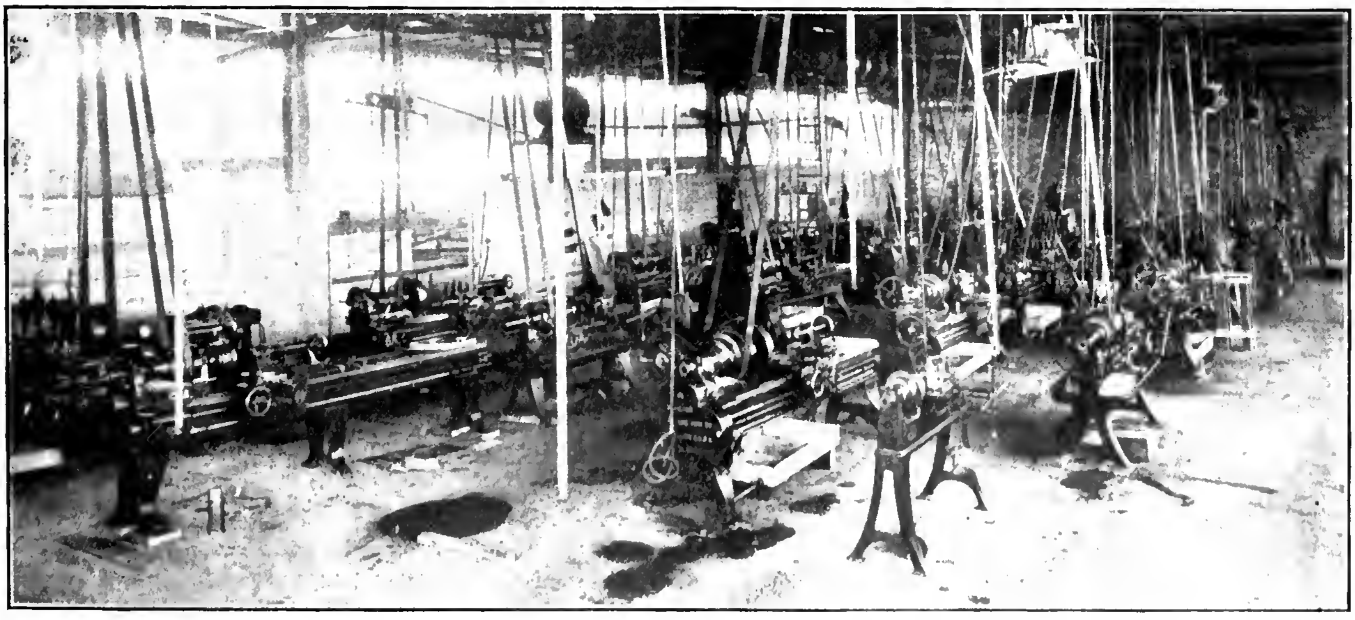


FIG. 12. GENERAL VIEW OF SHELL DEPARTMENT.

Tool B is formed of two parts so that if one corner is broken off in undercutting the whole tool is not scrapped, but just the broken half. In operation, tool B is fed straight into the shell to the required depth and then moved to each side to form the undercut.

A relieved portion in front of the tool leaves the proper amount of material which is formed into waved ribs or threads by tool C. After tool B has operated, the toggle joint is straightened out by moving hand lever D to position shown by dotted lines, causing crossbar E to compress the springs F and maintain the roller G. in contact with cam plate H, the revolving of which imparts the reciprocating motion to tool B necessary to form the required number of waves per revolution.

The remaining operations of banding, band turning and varnishing the interior of the shell are performed in conventional manners and complete the making of the shell to the point where it is ready to be fixed. The thorough manner in which the work has been planned and carried out and the modern methods employed as evidenced by the use of "Cooper-Hewitt" mercury vapor lamps for lighting, and "Chapman" transfer trucks for handling material, show that the firm in line with other Canadian shell makers is fully determined to supply shells to the utmost capacity of the plant, and of satisfactory quality.

SOCKET DRIVING MACHINE.

THE use of a drill press instead of a hand wrench for driving home the brass socket in the nose of shrapnel shells effects a double saving. In the first place, a workman can maintain a higher rate of output for an indefinite period with far less fatigue; and, secondly, the tool employed can be used to reduce the amount of work necessary on subsequent operations. A large drill press, Fig. 1, with powerful double gearing, was used for this work. The shell (a) is held sesurely in the hinged vise (b) fastened to the table of the machine. A hollow mill (c) is fixed in the spindle, and, when fed down on top of the socket (d), the inserted teeth dig into the metal and take hold firmly.

Continued pressure on the feed lever screws the socket home, the point of tightening being indicated by the teeth of the cutter beginning to cut up the edge of the socket. The cutter is shown in Fig. 2, from which it will be noted that, when suitably designed and carefully operated, it does the work of a roughing tool for machining the outside edge of the socket. Owing to the close limits on the finished sizes of sockets, it is hardly practicable to complete the work at this point.

The heavy dotted lines in Fig. 2 show the outline of the rough socket, while the lighter dotted lines indicate the amount

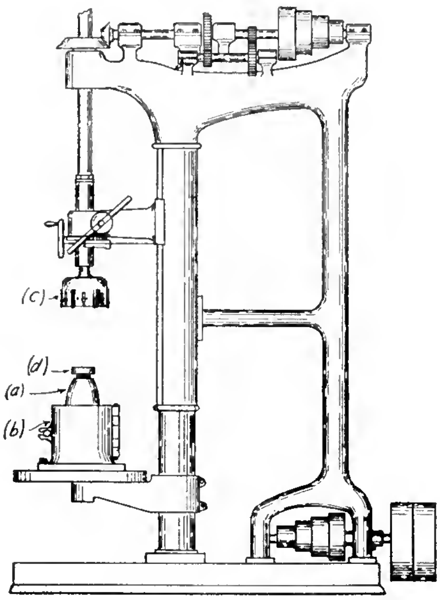


FIG. 1. TIGHTENING SHELL SOCKETS ON A DRILL PRESS.

left on for subsequent machining in lathe.

THE TEST OF WEAPONS

"IT is now the first birthday of the war, and as we look back the affairs of peace appear distant, vague and unreal. Once more the old world accepts violence and

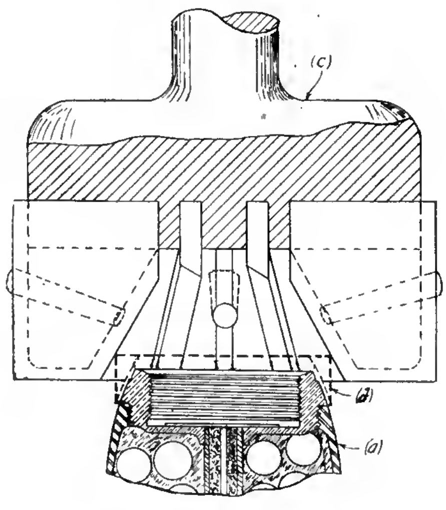


FIG. 2. HOLLOW MILL FOR SOCKET TIGHTENING MACHINE.

danger as its native element and puts everything to the test of weapons, and, if we may judge from the experience of a year, this great test shows mankind much as it always was and war much at it has always been. All the fine professions of peace have fallen away like a cloak, and nations fight after their customs of a thousand years.

"It may be food for the cynical philosopher to recollect that only eight years ago the delegates gathered at The Hague were full of busy ideas for making war humane and for civilizing violence, and expressing fine sentiments about 'the luminous star of peace' and the 'progress of human solidarity.'

"To-day the German public have made a song about the sinking of the Lusitania. In 1907 the Baron Marschall von Bieberstein was telling an admiring audience that 'the principles of humanity will be the surest guides for the conduct of seamen' and that 'the officers of the German navy—I say it with a high voice —will always fulfil in the strictest manner the duties which flow from the unwritten law of humanity and civilization.'

"War reveals nations and men in their true colors: it throws a searching light upon these fine professions, and it proves among other things that Germans at heart are much as they were in the time of Frederick Barbarossa, and that war is in its nature essentially the same as it was in the days of Rome."—Morning Post.

CANADA'S GAS AND OIL RESOURCES.

THE Mines Department, under the direction of Dr. Eugene Haanel, has completed a comprehensive and exhaustive investigation of the oil and gas resources of the Dominion, and it will be issued shortly in book form. The work of investigation has been carried on for the past year or so by a field survey staff under Mr. Clapp, one of the ablest petroleum experts of the United States. The Alberta oil fields has been thoroughly gone over and, while no large producing wells have yet been developed, promising indications have been found of the existence of petroleum in several districts in the Province.

A considerable portion of the report deals with the commercial possibilities of the development of the extensive and rich oil shale deposits of New Brunswick. If these deposits are exploited it is believed that a great industry can be built up, and a substitute found in Canada for the large quantities of petroleum and its derivatives now annually imported from the United States.

So important are these deposits and so great is the market for petroleum products in Canada, that the Federal Government has provided for a bounty of 1½ cents per gallon on oil recovered from oil shales in Canada. The distillation of oil shales in Scotland has been for many years a successful and flourishing industry. New Brunswick shales are on the average richer than the Scotch shales.

The total domestic production of petroleum is now under eight million gallons, while last year imports of gasoline totalled 27,451,379 gallons, and of petroleum in other forms over 200,000,000 gallons.

Why Steel is the Most Suitable Material for Shells

By J. M. W.

The exclusive use of steel for shell casings has occasioned inquiry by ironfounders into the possibility of cast iron being used as well. While the features of the case which have been brought to light by the discussion are so greatly in favor of steel, it must not be forgotten that steel is not perfect, and that any relaxation of stringent inspection, such as exists at present might be productive of results which must be avoided at any cost.

OCCASIONAL reports, chiefly from Belgium, that the Germans were using cast iron shells, have given rise to discussions on the merits of forged steel and cast iron as materials for shell bodies.

A momentary consideration of the requirements which must be met by either shrapnel or explosive shells is sufficient to make it obvious even to the lay mind why cast iron is quite unsuited for shell bodies except under extreme conditions such as now seem most unlikely to arise so far as the Allies are concerned. The purpose of shrapnel is to destroy men; the purpose of lyddite and other high explosive shells is to destroy the defences of the enemy so that infantry may attack. Entrenchments, fortifications, entanglements and other devices for defence are of such an effective nature that they must be literally blasted off the face of the earth before the opposing infantry can get into contact with each other. A hail of leaden bullets from shrapnel shell, no matter how fierce, has little or no effect on modern field works, consequently a copious stream of explosive shells must be distributed over the desired area so as to render the success of an infantry attack reasonably certain. Explosive shells which burst on contact may be used with delayed fuses, which allow a suitable space of time for the shell to sink into earth works to a desired depth, when the explosion of the charge resembles that of a mine. The immense hollows in the ground formed by the large siege guns firing half a ton of explosive are sufficient evidence of the power of high explosive ammunition. The disastrous results which would ensue from such an occurrence taking place in the barrel of a gun render necessary the absolute soundness of shell forgings, whether shrapnel or explosive.

Absolutely Safe Guns.

The absolute strength and safety of modern guns has been a wonder and mystery to the majority of laymen for many years; consequently the guns themselves have been discussed much more frequently than has the ammunition until the outbreak of hostilities.

Given good average material such as is procurable in the open market at the present moment, a good engineering education, and a high class engineering plant— and any resourceful man will produce a formidable gun with his personal experience and skill. The knowledge of ammunition manufacture, however, has for obvious reasons never been so widespread and available as that of guns. Even now with all their experience in shell work many producers have still to develop that patriotic interest in their product which is necessary to make them appreciate the strict inspection, and which would cause many so-called hardships to be viewed in their true light of precautions instead of being looked upon as hindrances to profit accumulation.

Rigid Inspection for Shells.

A true appreciation of the painstaking care and watchful economy which is necessary in producing shells at the present moment can only be obtained by a close study of the entire process from the time the iron ore enters the furnace until it leaves the muzzle of the gun as a shell. While the actual composition of the steel is decided on and controlled by a limited number of individuals, the mechanical and thermal treatment of the material is being performed by thousands of individuals, the majority of whom endeavor to effect every possible economy in time and material. That considerable economy in material has been accomplished is evident from published results obtained by a leading English metallurgist. Losses of 40 per cent. have been reduced to 15 per cent. with very little increase in cost, and no decrease in quality. The amount of labor lost on partly machined shrapnel forgings has been quite an item, but if shell makers calmly considered the matter from the steel makers point of view, they would not be so disposed to condemn offhand a product which represents the application of so much specialized knowledge and labor.

Steel Maker's Troubles.

The steel maker is not desirous of losing the profit as well as the actual cost of shell forgings which develop defects in course of machining. Government and personal inspection of material in all stages of manufacture is planned and carried out with the object of insuring perfect material and workmanship.

The results of Sir Robert Hadfield's investigations are of prime importance at this time. Steel which has been cast in ingots by ordinary methods may appear perfectly sound while not actually so—it may be rolled into billets—it may be forged into shells—and at all stages up to heat treating it may pass all physical tests satisfactorily with the one possible exception of an examination of the microstructure. After an ingot is cast, it is not again heated to a high enough temperature to cause the removal of piping defects, consequently the lack of what may be termed "cohesive density" persists in the metal till such time as it is finally heat treated.

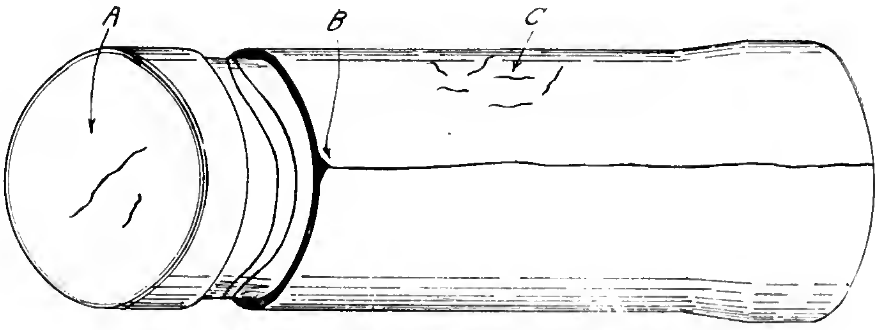


FIG. 1. DEFECTS IN SHELL FORGINGS.

When Defects Appear.

At this stage of manufacture hitherto unnoticed defects in shrapnel forgings, occasionally begin to appear. Flaws of various kinds become quite evident, although the most careful inspection before heat treating failed to reveal the slightest evidence. This trouble has caused considerable loss to both steel works and manufacturers, and the fact that it has occurred in spite of all inspection, etc., would indicate that the

steel makers are continually confronted with a serious problem. The hypotheses which the writer advances in explanation of well-known and recognized defects in shell forgings are based on personal experience in producing many thousands of shells and the conclusions arrived at are offered to manufacturers in the hope that a clearer knowledge of their cause may assist in timely detection and, ultimately, their complete elimination.

In Fig. 1 is shown a shrapnel shell with three distinct flaws, which are due to three entirely different causes. At A is indicated what is perhaps the commonest flaw. One or more cracks may open up and become visible after the shell is hardened. They may be only one-eighth inch long, or they may be one inch and eight. They may be less than one sixty-fourth inch wide, or they may be one-sixteenth inch. While most parties who have experienced this trouble seem agreed that it is developed in forging, there has not been advanced, so far as the writer is aware, any definite theory which satisfactorily accounts for their occurrence.

A Crack Theory.

It would seem not improbable that these cracks are formed when a certain combination of circumstances occurs in the course of forging operations. In starting up forging after say a week-end stoppage, the drawing punch and dies would be well cooled down, while some pierced billets might be soaking at a high heat. The combination of the cold punch inside, and cold dies outside would chill the walls of the forgings much more quickly than after running steadily for some time. The probability of an extra long billet would call for extra power, causing excessive tension in the metal on the outer layers of the base, which as suggested might possibly be at a rather high heat. While a rupture might take place at this time, it would not weld together again, but the close contact of the surfaces due to shrinkage would conceal the defect until the tension induced in the outer layers by their sudden contraction when quenched, would open them sufficiently to make their presence noticeable.

Forgings, in which the thickness of the base was well oversize, would be more or less immune from this trouble, not only because the extra metal would provide increased resistance to rupture while passing through the drawing die, but also because the extra metal is removed from the outside of the bore more conveniently than from the inside. Even if there were any slight cracks, in spite of the thicker metal in the base, they would in all probability be removed in facing the base of the shell to the required thickness.

Other conditions under which they would occur would be when the forging shop was working too closely to the minimum thickness of base. This would be most likely to happen when the forge shop was getting low on material and endeavoring to work in billets which might be a trifle undersize.

Neglect to clean out the piercing die also causes trouble through scale remaining on the bottom and getting pressed into the base. Shells have been observed with quite large defects from this circumstance, the cavities caused by the scale or other foreign matter, sometimes extending completely through the base.

Flaws Due to Rolling.

At B, Fig. 1, is indicated a flaw which occurs previous to forging. In the particular shell referred to, this flaw extended from the nose to the driving band groove. About 1-64 inch in width it could be felt distinctly with the finger nail, and, where it terminated at the driving band groove, it had broken away on either side leaving a scaley surface exposed. While at first sight it might be considered due to piping, the fact that it was only 1-16 inch deep, and did not extend over the base, would indicate rather the presence of some foreign substance or material which got worked into the bar during rolling operations, the end of the affected part happening to terminate at the groove as described.

Flaws of this kind are not dangerous in the sense of being concealed or difficult of detection. Had there been a smaller amount of foreign matter rolled into the bar, it would have been entirely removed in machining, but an internal flaw due to lack of homogeneity in the ingot could quite well remain undetected at all stages of the work.

Fissures.

At C, Fig. 1, are indicated a number of minute hair-like cracks or fissures from one-quarter to three-quarters of an inch in length. In some particular makes of forgings these fissures would be quite numerous. Their behavior was similar to flaws A, with the difference that they were more noticeable when the shells were ground instead of turned. At one period in the business, considerable trouble was experienced with hard streaks which were attributed to segregation of manganese. While opportunity did not afford full investigation at the time, the conclusion was accepted as probable.

The matter of fissures in shrapnel shells has been the subject of recent discussion in England, the theory advanced being that regions of low carbon and high phosphorus resulted in layers of different hardness. The low carbon layers being more elastic would accommodate themselves to strains brought about by quenching, while the high phosphorus layers owing to their different behaviour, would be subject to local strains which might develop in the form of fissures such as have been observed.

The fact that defects such as these mentioned can, and do occur in the handling of steel forgings, renders it obvious even to the lay mind, that the use of any material which is less reliable than steel, can only be justified by the exigencies of the situation.

Regarding Cast Iron.

The most that can be said for cast iron is that it is better than nothing. The almost entire absence of elongation results in such brittleness that in order to be absolutely safe, a cast iron shell would have walls so thick that the number of bullets contained would be so greatly reduced that the killing powers of the shell would be negligible. The probability of blow holes in the walls would disturb the balance of the shell during flight so as to destroy all accuracy of fire. The presence of cast iron shells on a modern battlefield indicates two possible contingencies:—either the demand for shells is so abnormal that a sufficient amount of raw material can not be obtained, or else the supply of steel is so much below normal that the normal consumption of shells cannot be met.

The inference is largely a matter of degree, but the results cannot be other than favorable to the cause of the Allies.

MUNITIONS INVENTION COMMITTEE

THE Minister of Munitions has constituted a Munitions Inventions Branch of the Ministry, and has appointed as Comptroller E. W. Moir, M. Inst. C.E., M. Am. Soc. C. E. The branch, which for the present is located in Armament Buildings, Whitehall-place, will have the duty of considering projects for inventions relating to munitions for warfare on land, or matters appertaining thereto. The Comptroller and staff of the branch will be assisted in their work of examination, and, if thought necessary, in the investigation and development of any projects that may be considered worthy of being developed, by a panel of honorary scientific and other experts.

In order to prevent time fuses from turning whilst in transit, Krupps solder a wire across them sufficient to hold them in place, but yielding easily to the pressure of a key in the gunner's hand.

H. E. Shell Production in Ventilating Equipment Plant

Staff Article

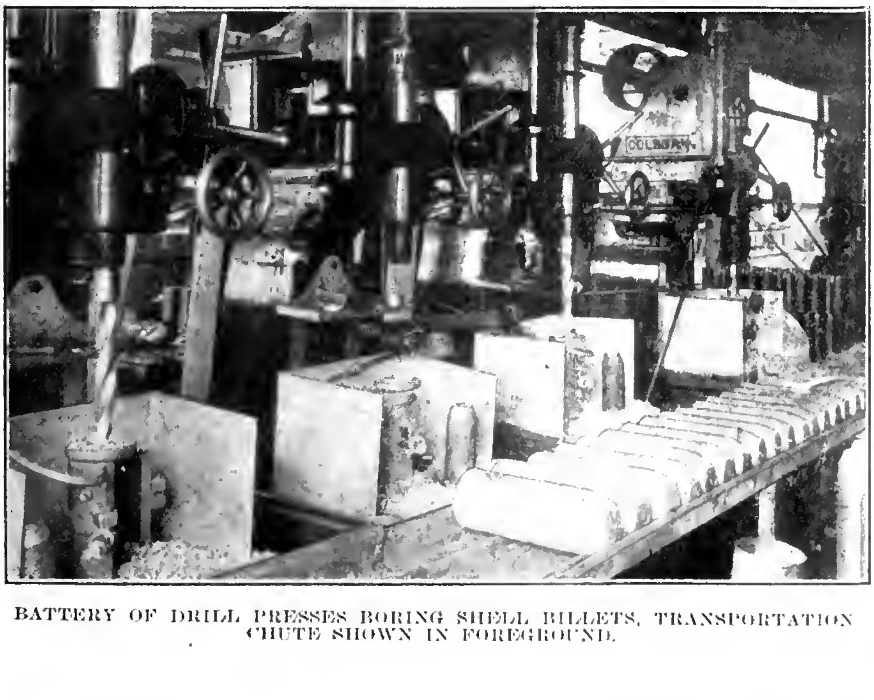
The plant which forms the subject of this article was among the first in Canada to undertake the production of 18-pdr. lyddite shells. Being accustomed, however, to manufacture machinery for special duty, little, if any difficulty was experienced in tackling successfully these war-time commodities. In addition to designing several ingenious fixtures and tools, a number of special machines have also been built and requisitioned for the work.

THE number of firms engaged in the manufacture of high explosive shells will no doubt increase, the demand for this type of shell having become quite insistent. Although some firms have reached the shipping stage and have overcome many of the difficulties with which they had to contend, there are others who have yet to go through the mill. The latter, however, will have the opportunity of benefiting from the experience gained by the pioneers and will no doubt take full advantage of it.

At the plant which is the subject of this article, 18-pdr. high-explosive shells are being made, the operations differing in many respects from those performed at plants which have already been described in **Canadian Machinery**. This feature will lend additional interest, especially in view of the fact that the results in most cases have been highly satisfactory. One feature worthy of notice is the method of centering the bar stock or billet at the base and using the centre instead of a chuck in practically all the more important operations, until the base recess is formed. This is done to obtain as concentric a shell as possible and at the same time increase production. The system of chutes between the machines in the earlier operations assists materially in speeding up production and reducing cost of handling.

The operations may be said to be divided into two sections. The first series are performed with practically only one exception on drilling machines which occupy a corner of the main shop on the ground floor. The second series, including rough turning the body, to the final operation, are all taken care of on the gallery over one bay of the main shop and extending the entire length. This arrangement was found to utilize the available space to the best advantage without interfering in any way with the ordinary or normal business of the concern. The layout of the plant is such that labor entailed in handling the billets and shells is reduced to a minimum with a consequent saving of time and money. The section of the plant used for making shells was laid out for this purpose, and it was thus possible to install each machine in its proper location to suit the sequence of operations.

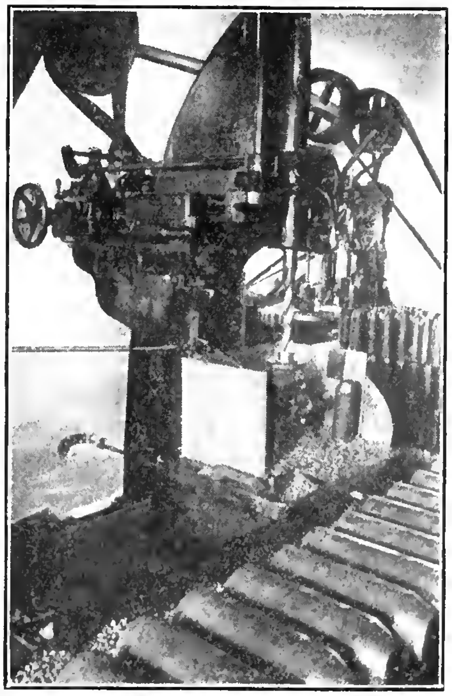
The drilling machines on the main floor already referred to are arranged as close together as is desirable, so that the shells can be conveyed from one machine to another by chutes in order to eliminate handling as much as possible. The billets are delivered to the shop and stored quite close to the machines, a supply thus being always at hand when required. In this section of the plant all the operations are performed from centering the bar stock to finishing inside, including threading the nose. A feature to be noted is the extensive use of drilling machines for the initial operations.



BATTERY OF DRILL PRESSES BORING SHELL BILLETS, TRANSPORTATION CHUTE SHOWN IN FOREGROUND.

Centering Billets.

The billets are first prepared for centering by grinding the corners and ends



BORING OUT SHELL BILLETS ON A "COLBURN" DRILL PRESS.

on a Canadian Buffalo Forge Co. grinder. They are then placed on a chute and passed along to a bench alongside which is a drill for centering the nose end of the billets. The drill was built by the Canadian Buffalo Forge Co., Berlin, Ont. The billet is held securely in a vise fastened to the drill table, and the centre drilled and countersunk in one end only. When this operation is completed, the billets are passed down another chute to the nosing machine. The nosing or rough turning the nose is done on three engine lathes. In this operation, one end of the billet is held in a collet chuck while the other end is being rough turned.

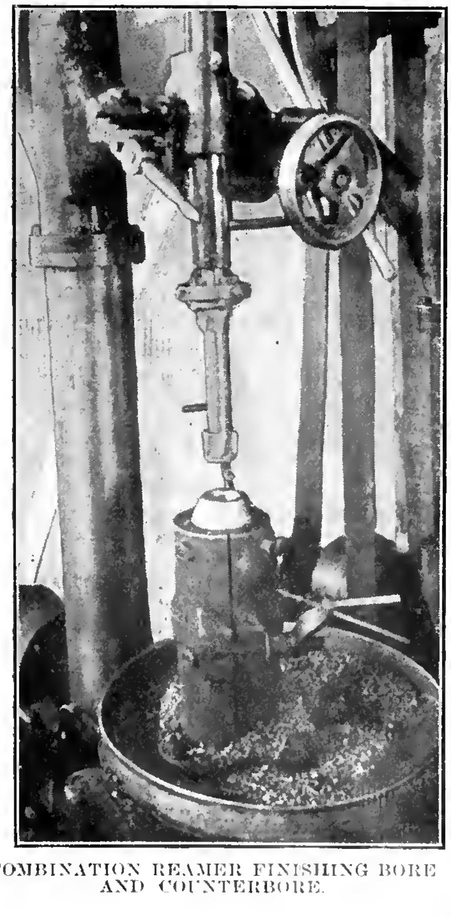
Rough Drilling Billet.

A battery of five heavy duty drilling machines is installed for the first drilling operation, which consists of a roughing cut only, the hole being finished later with a reamer. Four of these machines were built by Baker Bros., Toledo, O., and one by the Colburn Machine Co., Franklin, Pa. The "Baker" drills are all of the same type, and the "Colburn"

drill is very similar. Each machine is equipped with the same type of vise fastened to the table for holding the billet. The vise is a circular shaped device, one half being hinged and embracing a clamp. The stationary part of the vise has an extension bracket above with a hole in the centre through which the drill passes. The bracket supports a hardened steel collar used for keeping the drill central when beginning the cut.

The billets are laid out on a chute in front of the drilling machines, and when drilled are passed along to a bench behind for the next operation. Some interesting figures are available on the drilling operation. The four "Baker" drills operate at 130 r.p.m. with .013 feed, and the "Colburn" at 160 r.p.m., .019 feed. Whitman & Barnes and John Morrow & Son twist drills are used with the above machines. The installation of more drill presses is contemplated, these to be made by the Buffalo Forge Co., of Buffalo, N.Y., and designed especially for this work to operate at 190 rev., .020 feed. The hole in the billet is 1 13-16 in. diameter by 8¾ in. deep, and with the new drills this operation will take 2 minutes and 30 seconds.

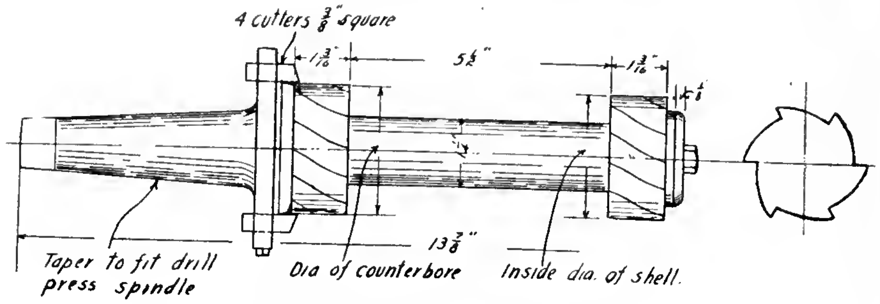
The bottom of the hole, after drilling, is of course the same shape as end of drill, and more metal must be removed in order to obtain the desired profile. For this reason the bottom of the hole is roughed out and reamed later. The roughing operation is done on a drill press supplied by the Aurora Tool Works, Aurora, Ind. The billet is held in a vise the same type as is used for the first drilling operation. The bottom of the hole is roughed to relieve the finishing tool at a later operation.



COMBINATION REAMER FINISHING BORE AND COUNTERBORE.

Inside Finishing Operations.

The next operation consists of finishing the inside body, reaming the counterbore, and roughing fuse plug seat. A 20-in. drill press built by the Canadian Buffalo Forge Co. is installed for this work. An interesting feature of the operation is the combination reamer designed by the Canadian Buffalo Forge Co. The reamer is about 13⅞ in. long over all and has a taper shank for fitting into the drill press spindle. At the end of the shank the reamer widens out, and has slots for four fly cutters. These cutters are ⅜ in. square and have a bevelled cutting face for forming the fuse plug seat. The cutters are held securely in position by a ring with a set-screw for each. Under the set of cutters is a reamer for finishing the counterbore in the nose preparatory to being threaded. At the other end of the spindle, the exact distance away, is another reaming cutter for finishing the bore of the shell. The cutters are secured to the spindle by dowel pins. In operation, the bottom cutter starts at the top of the hole, and travels down with power feed, followed by the cutter above. When both have nearly finished their work, the four small cutters above begin the form of the fuse plug seat. This combination makes a very accurate and efficient tool.



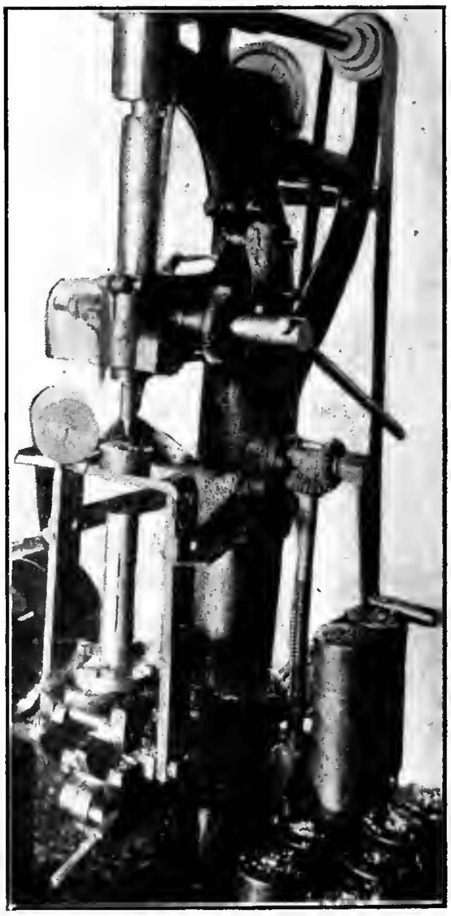
COMBINATION REAMER DETAIL.

Finishing Base Inside.

The bottom of the hole is finished on a 20-in. Canadian Buffalo Forge Co. drill press. The reamer has a long shank and is made with radius to suit the profile inside of the base. The shell is held in a hinged vise as in the previous operation.

In using unskilled labor it has been found advisable to do only one operation at each machine, and this principle has been followed as much as possible. Three drill presses, however, are equipped with a quick change "Wizard" chuck made by the McCroskey Reamer Co., and at the one setting of the shell the combination reamer is first inserted followed by the finishing reamer which can be inserted without stopping the drill.

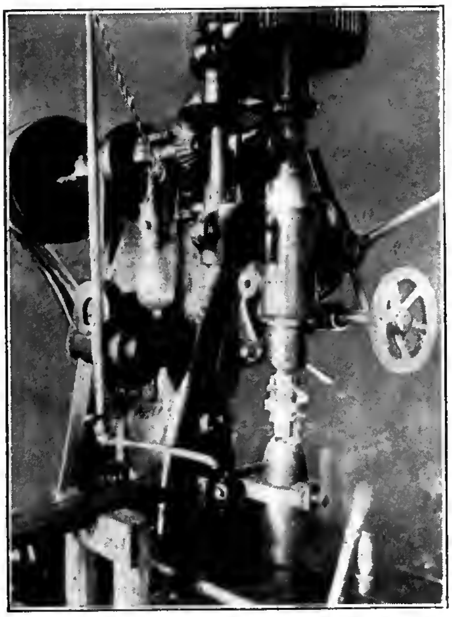
The shells are now moved to an adjoining machine to have the undercut or recess formed in the nose at the end of the counterbore. This undercut is necessary to give clearance for the threads. A 20-in. Canadian Buffalo Forge Co. drill press is installed for this operation. An expanding mandril fits into the drill press spindle. At the end of the mandril projecting out at the side is a small cutter the same shape as the undercut. The shell is held securely in a vise on the table, and the drill press spindle lowered until the cutter is in the correct position in the nose. A hand-wheel on the drill, when turned, causes the mandril to expand, and at the same time forces the cutter outwards, thus producing the undercut. This tool was made by the Toledo Twist Drill Co.



CENTERING OPERATION.

Centering Base.

It is necessary to centre the base end, as during several of the subsequent turning operations this centre is used. By always working from this same centre greater accuracy can be obtained and the shell will be concentric. This centering operation is done on a Canadian Buffalo Forge Co. drill press equipped with a special fixture for holding the shell. The base of the fixture is fastened to an arm extending from the drill press, and an expanding mandril is mounted on this base and works on a hinge so that the operator can swing it out to put the shell on. The mandril expands inside the shell and when moved into the vertical position holds the latter steady while being centered, the shell, of course, being nose end down. A bracket attached to the base of the fixture comes up over the shell and has a hole in the centre for a hardened steel guide to keep the drill and countersink central.



THREADING SHELL NOSE WITH COLLAPSIBLE TAP.

Threading and Tapping Nose.

The nose is threaded on a "Baker" drill, having a "Murchey" collapsible tap fitted in the spindle. A specially designed fixture for holding the shell is fastened to the table. This fixture has a floating clamp which holds the shell firm, but permits side movement; and is therefore self-centering. The centre in base of shell rests on a centre on drill table, while the shell is held in a clamp connected to a bracket at the side by means of a swinging hinge. A set-screw in the clamp keeps the shell from turning round while the nose is being tapped.

The sizing of the thread is done on a Canadian Buffalo Forge Co. 20-in. drill press with a standard sizing tap. The shell is held as before on a centre, with a floating clamp to keep it from turning. In the drill spindle, a Modern Tool Co. ball drive friction chuck is used, with a special bevelled facing milling cutter attached to the bottom of the chuck just above the tap. After the tap has been run down the full distance, the collar operating the ball drive is pushed up, which allows the milling cutter on the chuck to revolve, and there is sufficient clearance left to allow the cutter to be brought down to face the fuse hole seat on the end of the shell. This ensures a seat perfectly true with the thread. The drill is then reversed and the tap is backed off. One operator turns out 25 to 30 an hour.

After sizing, the shells are taken to a bench to have a centre plug screwed in the nose. They are then placed on a chute, at the end of which is a chain elevator, and are carried up to the floor above for the next series of operations. As the plugs are done with upstairs, they are sent back through a chute to be used again.

Rough Turning Shell Outside.

The lathes for performing this operation are situated at that end of the gallery above the drilling machines on the ground floor. They are, therefore, quite near the top of the elevator which brings the shells up to this floor. On leaving the elevator the shells travel down a chute within reach of the lathe operators. Four lathes, built by the Reed Prentice Co., Worcester, Mass, are installed for this operation, which consists of rough turning the body outside, roughing the copper band groove, and part of the base.

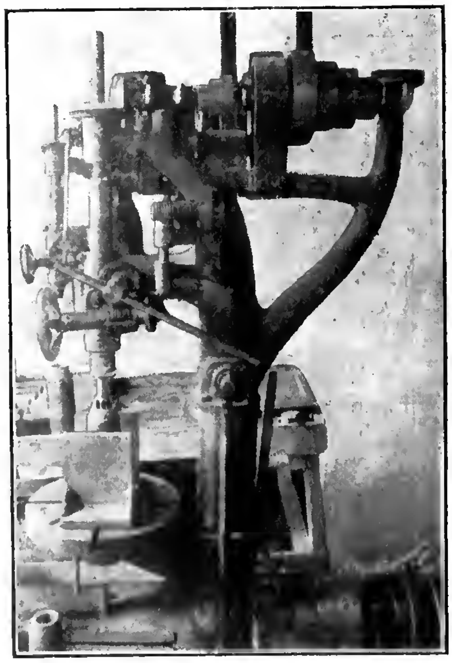
A centre plug has already been screwed into the nose of shell and fits the drive chuck. Both ends of shell are carried on the lathe centres. In front are two tool blocks mounted on separate cross slides, holding one and three tools respectively, the former for turning the nose, and the latter for the straight part of body. The tools are fed to the work by a cam device located under the cross slides, and attached to the lathe bed. A roller under the cross slide works in the cam. The left-hand tool rough turns the nose profile, the cam controlling the travel of cross slide. The three tools in the other tool block, rough turn the straight part of body.

While the front tools are working, the back arm is brought forward with its two tools and roughs the groove for the copper band, also squaring up the base of shell. Sufficient metal is left in the groove for the undercut and wave lines, which are finished at the next operation. The arm is clamped to a heavy bar at the back of the lathe, working in bearing brackets on headstock and tailstock. A projecting piece from the bottom of the arm has a roller which moves in a cam attached to a bracket on the lathe carriage at the back. The cam determines the feed of the back arm tools by moving the arm forward as the carriage travels. A stop in the bed in front controls the travel of carriage. After this operation the shells are arranged in racks.

Waving and Undercutting Copper Band Groove.

The next operation consists of forming the wave lines and undercut in the copper band groove. This is done on two "Reed-Prentice" 14-in. lathes, equipped with suitable tooling fixtures for the work. The shell has a centre plug in the nose, and is carried on the lathe centres, as in the preceding operation. Each lathe is equipped with a combination three-point cam and drive chuck, the latter having a square hole in centre to take the head of plug centre in shell nose, the same method being used in the preceding operation.

The waving tool box is in front and moves in longitudinal slides, the whole fixture being mounted on a cross slide. A bracket with a roller projects from the left-hand side of the tool holder. The roller at the end of the bracket is held up against the cam face by a spring on the opposite side of the tool holder. The cam oscillates the tool and gives the necessary motion to the waving tool. The tool has a square face with two vees for forming the wave lines. For feeding in the tool a cam is fastened on the lathe carriage under the cross slide, which has a roller underneath moving in the cam. As the carriage travels along, the cam forces in the cross slide and also the tool.



SIZING THREAD IN NOSE AND FINISHING FUSE-SEAT.

The undercutting tools are carried in two holders mounted on a fixture at the back of the lathe. They are hook-nosed,

right and left-hand, and are inverted. The holders are located close together and move in diagonal slides. The feed is taken care of by a cam fixture similar to the one which operates the waving tool. When the tools are feeding in, they are gradually forced apart, thus forming the undercut.

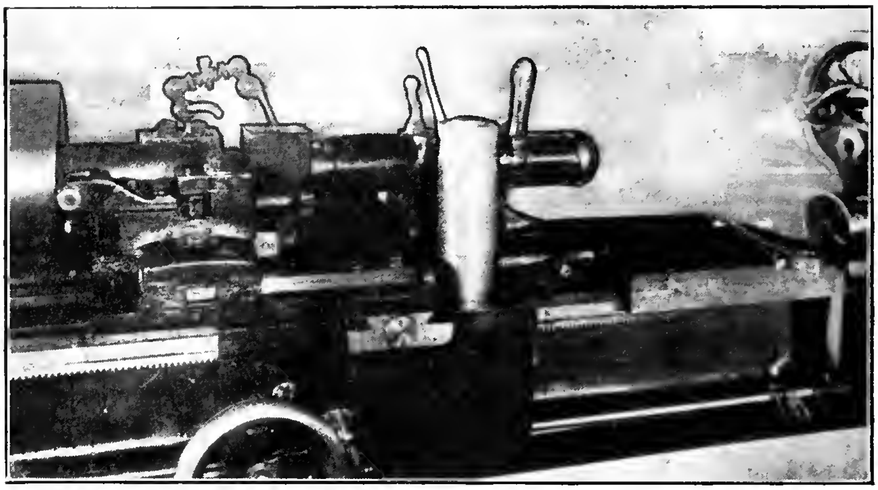
Finish Turning.

For the finish turning operation the same type of "Reed-Prentice" lathe is used as for rough turning. There are four of these lathes installed, and they are tooled up in a similar manner as the lathes used for the rough turning operation, with the exception of the back arm tools. In this case there are two arms, one having a tool for forming the corner at the base and the other for forming the fuse cap seat outside the nose. Three tools in one tool box in front finish turn the straight part of shell body, while a single tool, also in front, finishes the nose profile. The feeding-in cam is arranged in the same manner as on the roughing lathes.

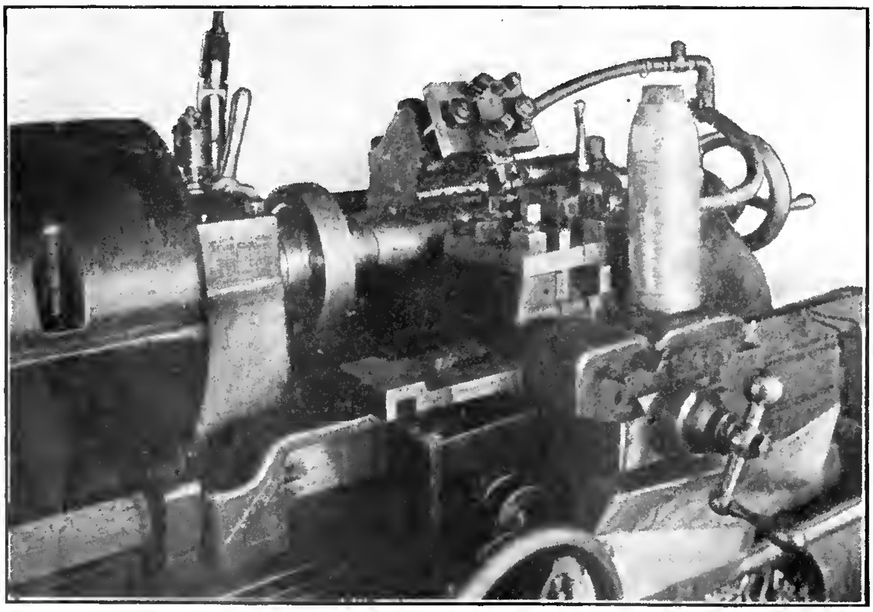
The back arms are operated, as in the roughing operation. The arm at the nose end holds a tool which forms the seat on the outside of the nose for the fuse cap, while the arm at the base end holds a tool for rounding the corner of base. These arms are brought forward when the front tools have nearly completed the travel. The shell has a plug centre in the nose, as in the two preceding operations, and is carried on the lathe centres, the same type of drive chuck being used as for the roughing operation. The lathe stops automatically when the tools have finished cutting. As the operation begins to move the carriage back, a catch on back of the carriage engages with a vertical rod connected to an attachment on the countershaft which throws over the belt. The time taken in this operation is 2 min. 15 sec. for one shell.

Driving Band Operations.

The shells now undergo the preliminary shop examination and Government inspection, when the body and wave lines are carefully examined. The wave lines are then nicked with a chisel and the shells taken over to the banding press. The latter was built by the Canadian Fairbanks-Morse Co., and is of standard design for shell work. The press is operated by hydraulic power from a belt-driven pump located close by. After the copper bands have been pressed on, the shells are taken over to a lathe for the bands to be turned.



WAVING AND UNDERCUTTING.



ROUGH TURNING BODY, NOSE PROFILE, DRIVING BAND GROOVE AND BASE.

The copper driving bands are turned on a "McDougall" engine lathe, equipped with a band-turning attachment built by Lymburner, Ltd., Montreal. The attachment is fixed to the lathe carriage. It has three tools—one in front for roughing, one under the work, also for roughing, and a tool at the back for finishing cut. The front tool and the one situated under the work are both operated by the screw under the front cross slide. The front tool feeds in towards the work, but the other feeds in a direction parallel to it. The underside tool roughs the back of the copper band, where the most metal has to be removed. The front tool then roughs the whole width of band.

The finishing tool is in a tool holder on the back of the attachment. The tool holder moves in vertical slides, and is operated by a lever. The tool passes down behind the work and is set so that it shaves off the required amount of metal while passing. The plug centre is still in the nose of shell, which is carried on the lathe centres. The lathe is equipped with a driving chuck to take end of nose plug.

Base Recess.

The base of shell up to this stage has retained the countersunk centre which was used during the various turning operations. This centre now disappears when the recess in base is formed. Before the actual work on the base recess begins, a flat 1 13-16 in. hole is drilled in the base to remove some of the metal, and so relieve the tools at the next operation. This relieving work is done on a 20-in. Canadian Buffalo Forge Co. drill press.

Four turret lathes, built by the Davis Machine Co., Rochester, N.Y., are installed for forming the base recess. The shell is held in a chuck, while on the turret are mounted the tools required for the operation. The turret is mounted on a cross slide, this feature being taken advantage of when boring out the recess and forming the undercut. The tool in the first turret face rough bores the recess. This tool is in the form of a cutter and is held in a boring bar. A stop with a roller at the end is fastened to the boring bar to regulate the depth

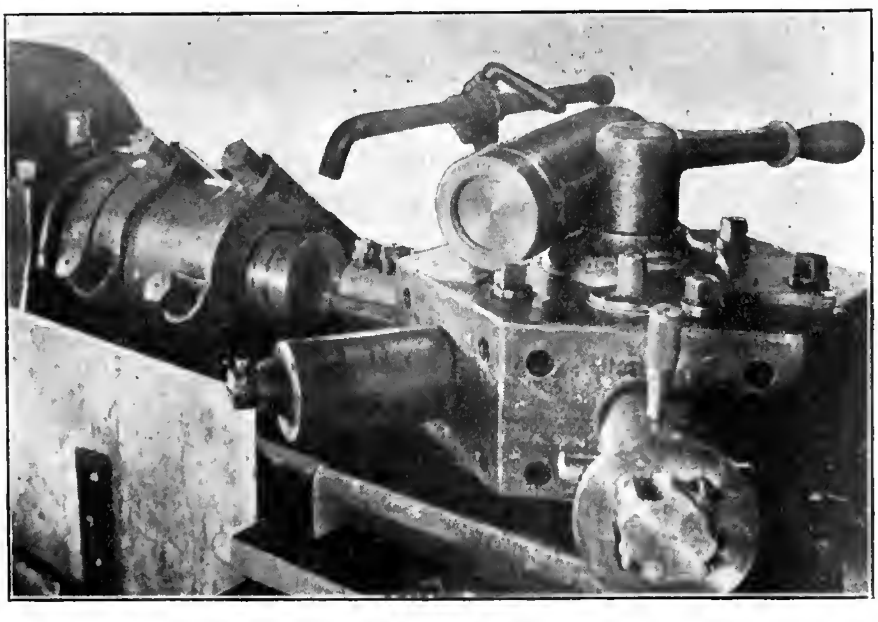
Shell Production Data

Operation.	Machine	Operators	Speed	Feed	Time
Grinding	1—Double griuder				1 min.
Drill	5—Buffalo heavy duty drills	1	190	.020	2 min. 30 sec.
Ream bottom	1—Buffalo heavy duty drill	1	190	Hand	1 min.
Nosing ream sides	3—24-in. engine lathes	2	100	1/32	2 min.
Counter bore and bevel face	5—Buffalo 20-in. drills	2	130	.040	2 min.
Undercut	2—Buffalo 20-in. drills	2	80	Hand	1½ min.
Ream finish bottom	2—Buffalo 20-in. drills	2	120	Hand	1½ min.
Centre base	1—Buffalo 20-in. drill	1	...	Hand	1 min.
Tap fuse hole	2—Buffalo heavy duty drills	2	40	Hand	1½ min.
Size fuse hole	2—Buffalo 20-in. drills	2	60	Hand	2 min.
Inspection of interior and insert drive plugs					
Rough turn	4—Reed-Prentice automatics	2	100	1/64	2 min. 15 sec.
Wave ribs and undercut	2—Reed-Prentice 14-in. lathes	2	100	Hand	1½ min.
Finish turn	4—Reed-Prentice automatics	2	100	1/64	2 min. 15 sec.
Banding	1—Fairbanks-Morse press	1	...	....	1 min.
Cut copper band to form	2—14-in. lathes with forming attachment	2	400	Hand	1½ min.
Drill 1 13-16 recess in base	1—Buffalo 20-in. drill	1	190	Hand	1 min.
Finish recess to 2¼-in. size	4—Davis 24-in. lathes	5	150	Hand	5 min.
Tap and size	1—Gisholt 24-in. lathe	.	40	Hand	5 min.
Drill ¼ fixing screw hole	2—Buffalo 20-in. drills	2	...	....	1½ min.
Tap ¼ fixing screw hole	2—Buffalo 20-in. drills	2	...	....	1½ min.
Assemble base plates	2—Jones & Lamson turret lathes	2	125	Hand	1½ min.
Cut off base plates	1—Hamilton gear machine	1			
Marking	1—Buffalo varnish tank and washing tanks				
Varnish	1—Brantford Oven & Rack Co. oven				

of the recess, the roller coming up against face of base, acting as a stop for cutter. The cross feed is taken care of by moving the turret. The second tool finishes the bottom of base and also the sides of recess for threading. This tool is of the same type as the roughing tool, and has a similar stop attached to the boring bar. The third turret face holds a boring bar, which has at the end a cutter for forming the undercut at the bottom of recess. In operation the tool is placed in position in the recess where the turret feeds across, thus forming the undercut. The fourth turret face holds a "Murchey" collapsible tap for threading the base recess.

Fixing Screw.

A number of minor operations now follow. The first is the sizing operation when the base is hand-tapped, the shells being moved along to a bench for this purpose. The ¼-in. fixing screw hole is then drilled and tapped. The hole is drilled on a Canadian Buffalo Forge Co. drill press, equipped with a specially-designed vise. The latter has a horizontal mandril, which is a sliding fit inside the shell, the mandril having a tightening device for holding base end of shell rigid. One end of the vise projects over nose of shell and carries a steel collar for guiding and locating the drill in the correct position. On a bench near the drill the hole is hand-tapped and sized.



FORMING BASE RECESS.

The shells are next cleaned and washed in a tank containing gasoline, afterwards undergoing another shop and Government inspection when the base recess is carefully examined.

Base Plate Operations.

The base plate operations consist of screwing the base plate into the recess, riveting the joint between base plate and base, and finishing the base. The base plate is a steel drop forging with a square head; the face has a slight camber and the periphery is threaded for about three-quarters of the width. The threads are covered with a cement composition before the base plate is screwed in, which is done by hand with a long wrench. When the base plate has bottomed in the recess the square head is twisted off.

The shells are now taken over to a power riveter to have the joint between the base plate and base closed up. The riveter was built by the Grant Mfg. & Machine Co., Bridgeport, Conn. The nose of the shell is placed on a cup-shaped block on the table while a bracket fixed to the frame above holds the shell steady. The hammer is operated by a friction pulley and is controlled by the operator by means of a foot lever. While the machine is working, the shell is turned round by hand one complete revolution.

The bases of the shells have now to be finished up, this being the last machining operation. A No. 3B "Milwaukee" miller is installed for this operation. A fixture is fastened to the table for holding 24 shells, two rows of 12 each, the shells being placed back to back with sufficient room in between for the cutter, and clamped to the fixture. The one cutter turns both rows of shells.

Marking.

After the base has been finished, the shells are taken along to a bench for the markings to be put on. The machine is fixed to the bench and was built by the Hamilton Gear & Machine Co., Toronto. This type of machine is installed in several shell plants.

Varnishing and Baking.

The shells while still on the bench have a brass ferrule screwed into the nose to prevent the varnish from coming in contact with the threads, the ferrule being taken out after the shells have been baked. The shells are filled with varnish from a tank, the tank used having been built by the Canadian Buffalo Forge Co. It consists of a double compartment, each side having a capacity of one barrel of varnish. The varnish is forced up from one compartment by compressed air. It flows up a pipe situated over the other compartment and the action is similar to a hot-

tle washer. The shell is simply slipped over the pipe, nose down, and, when lifted off, the inside is evenly coated with varnish free from air bubbles. The varnish runs down into the other compartment, and when the first compartment is empty and the other side full, the air pressure is diverted and the varnish is forced back in a similar manner.

It might be here stated that the object of the varnishing process is to protect the shell from the explosive, lyddite, which has a deleterious effect on steel. After the varnish has been poured out, the shells are placed nose down on a draining rack for a few hours preparatory to being baked.

A gas-heated oven built by the Brantford Oven & Rack Co., Brantford, Ont., is used for baking the shells. The oven is heated on the indirect system. On each side of the oven is a chamber with coils containing air which is drawn through ducts into the oven at the end by a Canadian Buffalo Forge Co. No. 2B exhauster. A gas burner is connected to each chamber and the hot gases flowing round the coils heat the air inside them. The air escapes through ducts located at the top of the oven. With this system, the gas fumes do not come in contact with the varnish in the shells, the hot air supplying the necessary heat. The shells remain in the oven eight hours, the temperature being 300 degs. Fah. The shells are arranged in racks before being placed in the oven.

Final Operations.

When the shells have cooled down, the ferrules are taken out and the shells are taken over to the Government inspector for final examination. The shells are carefully weighed, gauged and examined, and one from each series is selected for the firing test. The rest are then sent forward to the painting department where two coats of paint are applied, the priming coat being white and the second coat yellow ochre. A brass plug is then screwed into the nose, the threads being first covered with "luting." The shells next pass to the shipping room and are packed in boxes for shipment. The shell boxes used in this plant are made by the Hibner Furniture Co., Berlin, Ont., and the truck for moving the shell racks between the various operations on the gallery was supplied by the National Scale Co., Chicopee Falls, Mass.

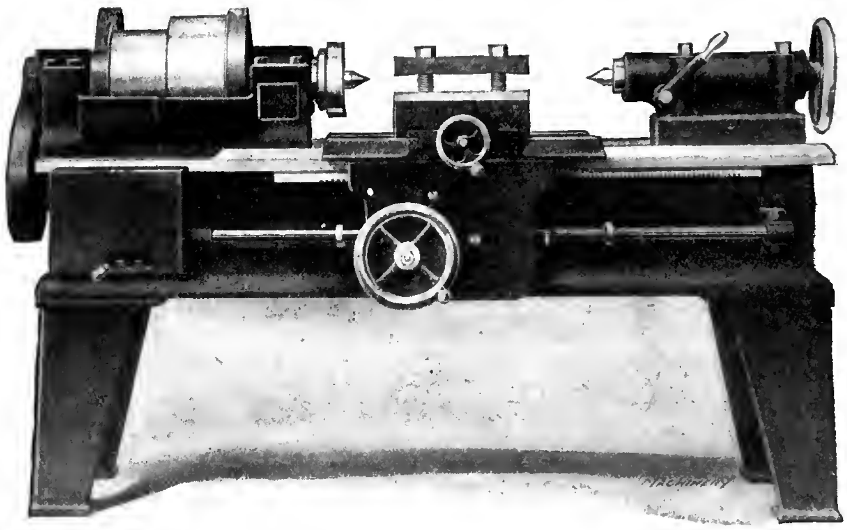
PROJECTILE MANUFACTURING LATHE.

THE opportunities afforded shell manufacture for the use of plain machines of limited capacity have been quickly recognized by machine tool builders. Among recent examples of these is the manufacturing lathe which has been put on the market by the Canadian Fairbanks-Morse Co.

It is designed to meet the demand for a plain heavy standard lathe, which can be easily handled by non-skilled labor, and in order to insure satisfactory service under severe and continuous duty, the provision of ample wearing surfaces and reliable lubrication, are distinctive features. The steel gearing is cut from the solid, and the headstock bearings are fitted with brass bushings and ring oilers. The lathe is regularly furnished with a solid spindle, having the nose bored for No. 5 "Morse" taper centre, but when desired it can be furnished with a hole 3⅛ inches diameter, and deep enough to hold a 3-inch shell.

The carriage has power longitudinal feed only. Automatic stops control this obtained by means of a shifting lever in the gear box. The feed is positively driven by gears from the spindle, all gears suitably covered. The tool box is of the European type, of ample proportions, and has hand cross-feed only. Two speeds only are furnished by the 6 in. wide cone steps, which are of 11 and 14 inches diameter respectively. The use of a two-speed countershaft provides eight speeds, the countershaft friction driving pulleys being both 16 x 6 inches.

The bed is 7 feet long and allows 21 inches between centres. A maximum swing of 16 inches diameter is available over the bed, and 10 inches over the carriage. The liberal proportions of spindle bearings—5 x 7⅜ inches front and 4½ feed in either direction; three changes of feed—⅛, 1-16 and 1-32-inch, being x 5⅜ inches rear—insure ample rigidity under severe service. When desired, this lathe can be furnished with various attachments for different operations.



16-INCH SWING, MANUFACTURING LATHE.

ENGINEERING IN GERMANY

THE Copenhagen correspondent of "Electrical Engineering" writes: "It is wrong to say that the electrical industry in Germany is disorganized. In my opinion it has never been so organized as at present, but the whole organization has been altered to meet the war requirements. The Government has taken over practically the whole supply of brass and copper and other metals useful for war purposes. A vast number of factories are working day and night on Government orders, and, as the German Government pays tremendous prices, the firms having this sort of work do not care for any other. However, in the electrical industry there are a large number of small firms, especially down in the Thuringen neighborhood. Most of these firms have no Government work, but they cannot supply the usual accessories because all their stocks of metals have been taken from them. Therefore, they have now to make lamp-holders, lamp-sockets, switches, and, in fact, all accessories, of brass-covered iron. With their usual technical thoroughness and cleverness they have succeeded in producing an article of first-class quality. The finished article looks exactly like brass, can be polished like brass, and, I believe, withstands moisture and other rough treatment. For a long time the Germans have been using insulated iron wires instead of copper wires."

Cheap Ammonia.—Ammonia, as ammonium sulphate, is produced cheaply as a by-product in the manufacture of coke in by-product ovens.

Steel and Shrapnel Bullets.—The least thickness of hardened steel that will keep out modern shrapnel bullets at fairly close range is ⅛ in. These bullets run forty-one to the lb.

Casting Steel Ingots for Production of 4.5 H.E. Shells

Staff Article

With a view to securing an increased output of 4.5 high explosive shells, cast steel billets are now being produced in our steel foundries through the medium of ingot moulds. Although in the earlier stages of the process considerable trouble and difficulty were met with, these have now been overcome and, in the particular plant under review, an output of over 4,000 shell blanks each 24-hour day is being achieved and continuously maintained.

WONDERFUL developments have been, and are still taking place in the iron and steel industry throughout the Dominion of Canada. While the manufacture of iron castings has for the most part in the past occupied the attention of foundrymen, that of steel castings is of comparatively recent date.

Prominent among Canadian concerns engaged in this production is to be noted the Canadian Steel Foundries, Ltd., of Montreal, etc. This company which was organized in 1910, have a large plant located at Longue Pointe on the outskirts of Montreal, for the express purpose of manufacturing steel castings of almost any size or shape, the meantime capacity being something over 3,000 tons per month.

The output had however been more or less restricted for some time owing to the generally prevailing industrial depression, but, on the advent of shell making, so great was the impetus imparted through the demand for shell steel billets, the plant is now running night and day to meet the new situation and at the same time do justice to its regular lines, among the latter of which may be mentioned locomotive frames, wheel centers, engine castings, high carbon rolls, dredge buckets, etc. A specialty is made of all kinds of steam and electric railway track work, such as frogs, switches, diamonds, intersections, etc. Vanadium steel is prominent in all products where great strength is desired.

The plant is located about a quarter of a mile from the St. Lawrence river and about a mile east of Montreal city boundary. The buildings are of structural steel and brick, erected on concrete foundations. A detail description of the constructional features was given in our October, 1912, issue of Canadian Foundryman.

The Steel Foundry.

This building is 436 feet long and has a width of 264 feet. It consists of five sections there being an aisle across one end of the shop.

The open hearth charging stock is brought into the shop and taken to the furnaces by a Morgan 5-ton, four motor high type charging machine. The two 25-ton acid furnaces, using oil fuel, are of the most modern design and construction, and should the oil fuel fail or be cut off a gas producer is arranged as a standby.

The first aisle on the east side is equipped with a 20-ton Dominion Bridge Co. crane and also a 30-ton "Morgan" crane, while jib cranes fitted with air hoists are on each side of every aisle for handling the flasks and moulds, all of the flasks being of heavy cast steel and in a variety of shapes and sizes.

Mould Drying and Pouring.

After the moulds are made they are taken on trucks to a battery of drying ovens equipped with "Kinnear" rolling doors. Following the drying, the moulds are removed to the casting floor and placed in readiness for pouring. Two 35-ton and three 24-ton steel ladles built by the John McDougall Caledonian Iron Works, are used in transferring the molten steel from the furnaces to the waiting moulds. One 20-ton Dominion Bridge Co., and two "Morgan" cranes of 30 and 40-ton capacity transport the above mentioned ladles.

Fettling Shop.

When the castings are sufficiently set they are shaken out and removed to the fettling shop which comprises the aisle at the end of the foundry. Here a variety of equipment prepares the casting for machining by removing all gates, fins, etc. This aisle is served by a 15-ton Dominion Bridge Co. and a 30-ton "Morgan" crane as well as by a "Whiting" electric travelling wall jib crane. A general view of this floor is shown in Fig. 1.

Billets for Shell Production.

Owing to the great difficulty on the part of many plants in obtaining rolled steel billets for the production of shrapnel and high explosive shells required

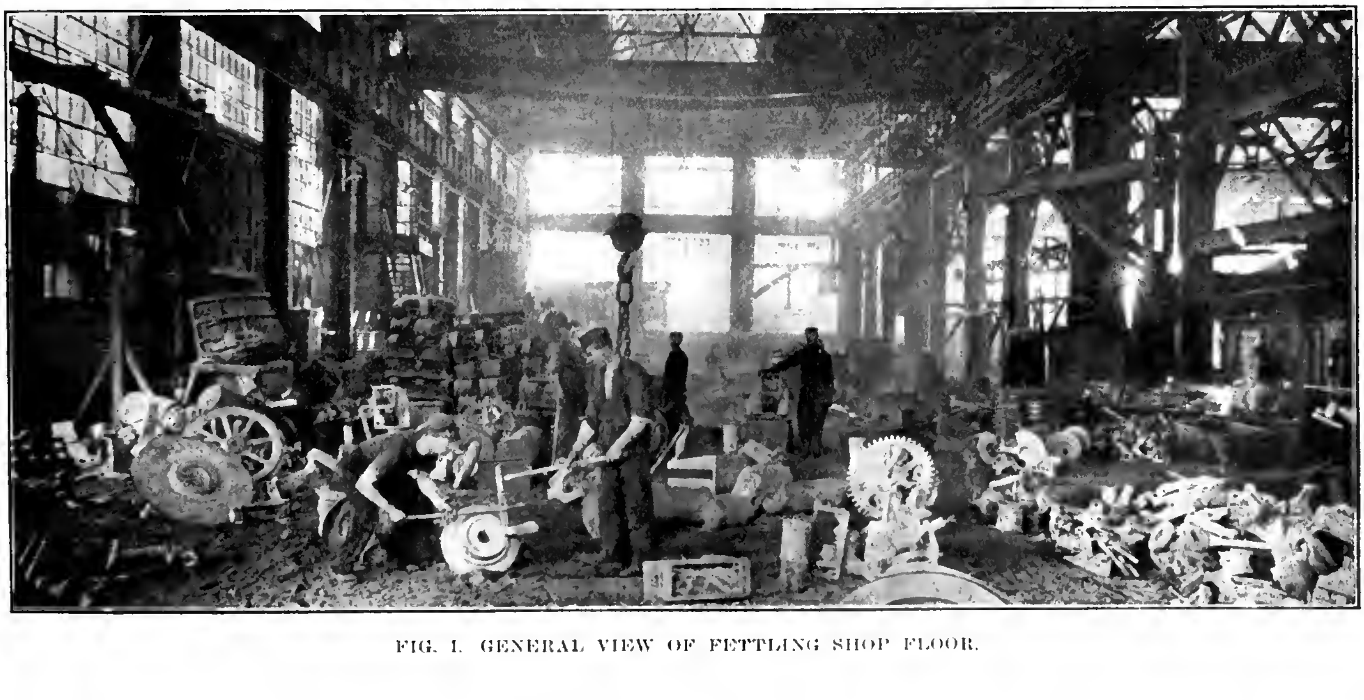


FIG. 1. GENERAL VIEW OF FETTLING SHOP FLOOR.

for the various European nations, our steel foundries have been scheming and experimenting with a varying amount of success so as to produce a grade of steel casting that would meet the requirements.

While the art of making steel in metal moulds dates back to the days when crucibles were first used in making small tool steel ingots, the more general adoption of metal moulds dates back only a few years.

On first thoughts it did not appear to be practicable to produce the desired grade of steel required for shells by the ingot moulding process, especially as the rough shell had to be forged from the cast ingot. However, after much time spent in experimenting, a stage has been reached at which almost every requirement is fulfilled. It was believed that the use of metal moulds would chill the steel and cause it to be unserviceable for shell making, but with moulds of proper proportions, results otherwise have been achieved. No annealing has been found necessary after the ingots are shaken from the moulds.

Government Specifications.

Government specification requirements for 4.5 shell steel call for the same standard of product as in the case of 15 and 18 pounder shrapnel shells. The steel must have a tensile strength of between 35 and 49 long tons, an elongation of about 20%, a percentage of carbon between 0.45 and 0.55; the quantity of nickel must not exceed 0.50, manganese to be between 0.40 and 1.00, and phosphorus not over 0.05 per cent.

A mixture that gives close results is composed of about 20 per cent. Chautauqua or a similar low phosphorus pig iron, 40 per cent. open hearth scrap steel and the balance of heavy melting steel scrap.

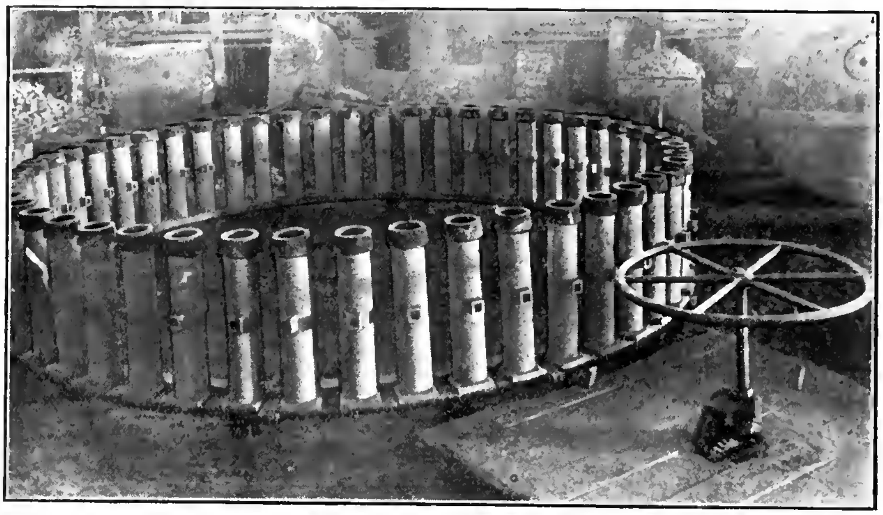


FIG. 4. BATTERY OF INGOT MOULDS READY TO BE POURED.

Melting the Mixture.

The steel is produced in two 30-ton furnaces by the open hearth process. They are fired with fuel oil at a pressure of 80 lbs. per sq. in. mixed with air at 100 lbs. per sq. in. The quantity of oil used is comparatively low, being about 3.3 or 3.4 gallons per ton of steel melted. One charge is melted in about 5 hours. The entire charge of about 25 tons is taken from the furnace by running it into a 40-ton bottom-pouring ladle shown in Fig. 2. This ladle, made by the John McDougall Caledonian Iron Works is built of heavy boiler plate lined throughout with fire-brick. The molten metal is poured from the ladle through an opening in the bottom which is stopped by a plug controlled by a series of rods and levers operated manually at some distance off. The stop plug which controls the flow of the metal from the ladle is made of graphite, the part entering the opening being conical in shape with the end somewhat rounded. This graphite plug is screwed on to a rod which extends down through the metal from the top of the ladle.

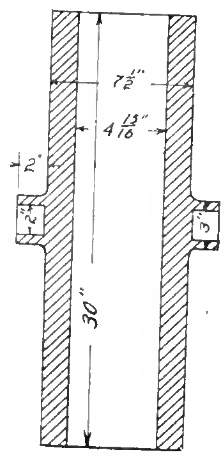


FIG. 3. INGOT MOLD.

To protect this rod from the action of the molten metal, it is covered with a series of fire-brick discs throughout its length. Owing to erosion the graphite plugs will only stand about 300 openings after which they are replaced by new ones.

FIG. 2. FILLING BOTTOM POURING LADLE AT OPEN-HEARTH FURNACE.

Shell Ingot Moulds.

A rough sketch of the moulds used for making the shell ingots is shown Fig. 3. At first the moulds were made somewhat shorter but as it was desired to get two blanks from each ingot, it became necessary to increase the length in order to get sufficient sound steel at the bottom. The trunnions are placed a little above the centre to facilitate handling with the crane, while both ends are faced off to obtain a good level surface. The caps for these moulds are made of facing sand in a core box and oven-baked. The general construction is shown in Fig. 6, the bottom end being narrowed down to facilitate removal.

Preparing the Moulds.

When the ingots were being first produced, it was the custom to stand them

in hit-and-miss fashion about the floor. This method was found unsatisfactory, however, as the crane operator had considerable difficulty in placing the opening of the ladle in the desired position. To overcome this trouble and also to facilitate the operations generally, the method shown in Fig. 4 was designed and is giving excellent results.

A rotary table with rack underneath is constructed to run on a track, and is operated by bevel gears and shafts leading to the large hand wheel shown in Figs. 4 and 5. These rotary tables are 16 ft. 8 ins. inside and 18 ft. 4 ins. outside diameter, and have flat surfaces upon which the moulds rest; the latter being held in position entirely by their own weight. At present there are four of these tables in use, each having a capacity of 50 moulds. There is also under consideration a new design which will involve a table to accommodate 2 concentric rows of 50 moulds each. This will do away with the handling of the crane after the first mould has been located.

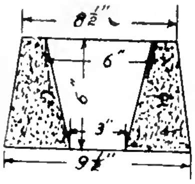


FIG. 6. INGOT MOLD CAP.

Pouring the Moulds.

After the charge has been taken from the furnace, the 40-ton ladle is picked up by the crane and taken to a position directly over the revolving table. When the proper location is found and the first mould poured, directions are given to the men at the controlling wheel and the table is revolved to the next mould. The man standing close to the ladle directs the movements of the crane operator and also the men at the wheel, his eyes being protected from the glare and heat by heavy blue glass goggles. The entire heat of around 25 tons is run off in about one hour.

FIG. 5. POURING A BATTERY OF INGOT MOLDS.

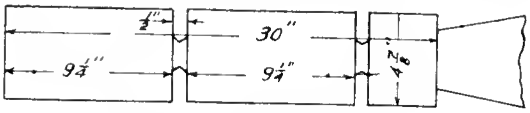


FIG. 8. SYSTEM OF CUTTING OFF BILLETS.

The magnitude of these operations can be best realized when it is known that an average of seven heats of 25 tons each, which is about 4,000 shell blanks, are run off every 24 hours.

Removing the Ingots.

When the ingots have properly set, although still quite hot, they are removed from the mould so that the latter can be prepared for the next pour. The ingots are raised by means of the crane and in most cases they drop out without any trouble, as the shrinkage, which

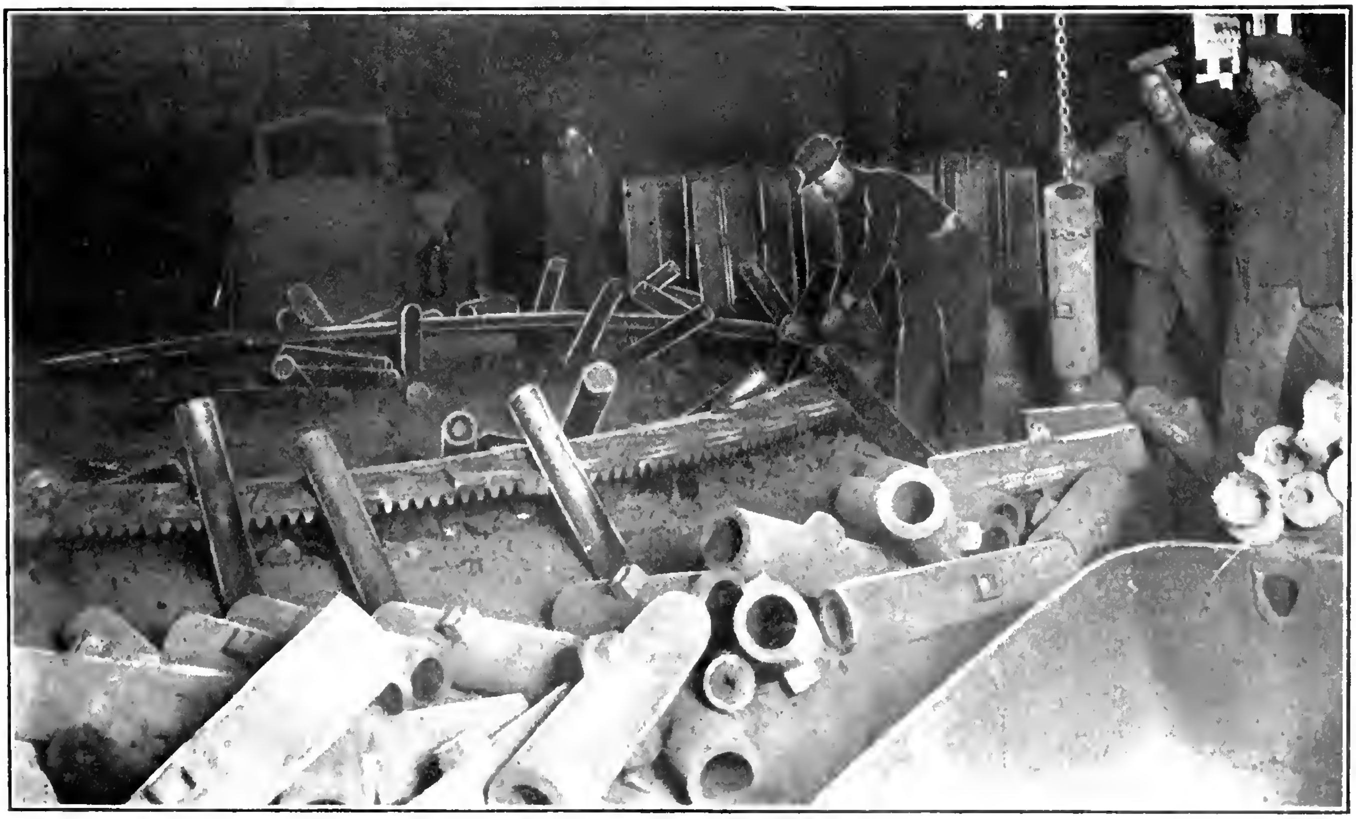


FIG. 7. SHAKING OUT THE INGOTS, SEVERAL OF WHICH MAY BE SEEN AGAINST THE TABLE.

is about 3-32 of an inch in the diameter of 5 inches, is usually sufficient to thoroughly free the ingot from the mould. Sometimes however, it is necessary to hit the ingot a blow with a sledge. If they do not come out with the sledge treatment they are taken to a "Bertram" horizontal hydraulic press and forced out.

Occasionally an ingot seizes in the mould, and when this happens the contraction will cause the metal of the mould to crack in one or more places; however, the loss in this respect is very slight, being less than 3 per cent. The walls are left thick enough to withstand the action of the heated metal, because, if too thin, the molten steel would tend to heat the mould so rapidly that the two surfaces would incline to weld together. After the ingots are shaken out, they are inspected for defects, such as fractures "piping," etc. The life of the average mould is about 200 heats. A view of the shaking out process is shown in Fig. 7.

Cutting Off the Billets.

After the ingots have passed the preliminary inspection they are cut into billets on several axle lathes; the length being 9¼ inches, and the width of cut being from ⅜ to ½ inch wide. The cutting off tools are of "Firth" high speed steel. Six lathes are employed in this operation, two of them being "Bridgeford" products and another two of "Bertram" make. The depth of cut is approximately 2 ins., the tools being fed in by hand. The average time for four cuts is twelve minutes, and about 200 billets are obtained in 10 hours. Each ingot weighs about 156 lbs. and is handled by means of a jib crane and air hoist. The Government inspection calls for a portion equal to about 1-6 of the cross sectional area to be left in the centre, so that, when broken apart it can be examined for fracture. A sketch of one of these ingots as it comes from the lathe is shown in Fig. 8.

Heat No.	Description	Dia.	Area	Elastic limit		Max Strength		Elongation		Red. dimension			Chemical Analysis					
				actual	per sq. in.	actual	per sq. in	in	per cent.	dia.	area	%	Car	Phos	Man.	Sul.	Si.	Va.
	4.5 How.	.461			19.2		40.70		25.7				.42	.031	.72	.032	.28	
	,,	,,			21.9	long tons	41.8	on 1.635"	27.6				.41	.036	.85	.032	.30	
	,,	,,			22.3		42.0		26.3				.40	.036	.87	.034	.27	

FIG. 9. RECORD SHEET COVERING CHEMICAL TEST.

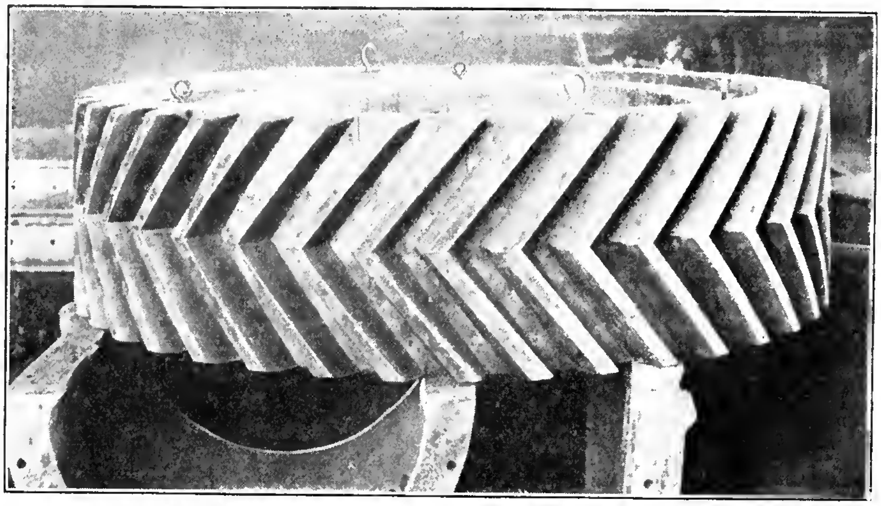


FIG. 10. PATTERN OF LARGE HERRING-BONE GEAR.

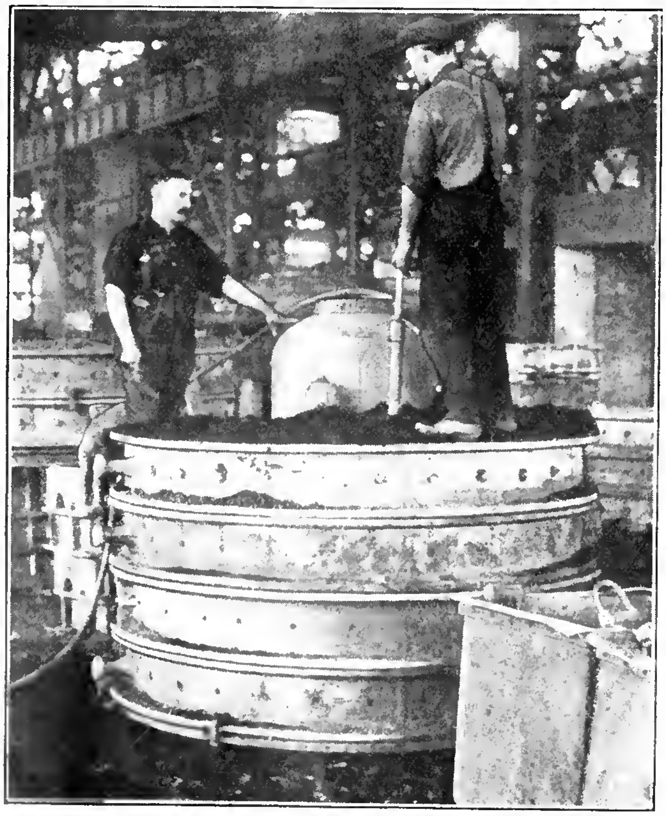


FIG. 11. PREPARING MOLD FOR LARGE STEEL HYDRAULIC CYLINDER.

Inspection.

The billets are broken apart by laying across a 3 x 4 block and striking with a sledge. The crop end is returned to the furnace for remelting and the billets again inspected for defects. If rejected at this stage they are stamped with the letter R. The buttons are removed by planing or shaping, or, if very shallow, by grinding. Two sample ingots are taken from each heat for analysis. Drillings are also taken for tests of carbon, sulphur, phosphorus and manganese. The carbon test is derived by combustion, as the color test gives only an approximation. Chemical and physical tests are made of each heat by the works chemist, also by the Government chemist, and records of these are preserved. One of these record slips is shown in Fig. 9.

General.

While this plant is busy at present supplying machine shops with steel billets for the manufacture of 4.5 high explosive shells a general line of heavy steel castings is also being turned out. An idea of these latter may be got from Fig. 10, in which is shown the pattern of a large herringbone gear of about 8 feet in diameter, and in Fig. 11, the mould for a large hydraulic press cylinder in course of preparation.

The first contingent of volunteer munitions workers left Johannesburg, South Africa, on August 5, for England.

SHRAPNEL SHELL PRODUCTION IN A SHIPBUILDING AND MARINE ENGINEERING PLANT

Staff Article

The sudden call from the manufacture of articles of a peaceful commerce to that of supplying the gods of war with provender of a prodigious amount and such as we never dreamed of producing, has been met by the administrations of our iron and steel industries in a manner that demands our whole-hearted admiration for their enterprise and resourcefulness. This particular plant is now making arrangements to manufacture 4.5 high explosive shells.

FROM building ships to making shrapnel shells represents somewhat a switching between extremes, and naturally called for changes in and additions to equipment. At the plant under review, however, little difficulty was experienced in finding room for a shell department which would not interfere with the ordinary work. A portion of the ground floor of the machine shop was taken over for the purpose and equipped with the necessary machinery. The floor or gallery above was also utilized for the making of shells. The heavier tools are installed on the ground floor and the operations up to and including the finish turning are done there.

On the gallery above, a banding press and band-turning lathe, a socket finishing lathe and a milling machine represent the machines installed, the greater part of the space being devoted to the assembling, painting and other hand operations, and to the housing of the inspection department. The entire plant is laid out so that the shells start at one end and are handled progressively until finished. "Chapman" elevating trucks distribute the shells between the various operations. Cutting compound supplied by the Cataract Refining Co., Toronto, Ont., is used exclusively on the various cutting tools. The heat treating department is located in a separate building outside of and adjoining the machine shop. This arrangement helps considerably in keeping the latter cool and free from fumes.

Although not among the first firms to undertake the manufacture of shrapnel shell, good progress has been made and little time has been lost in getting to the shipping stage. A number of "short cuts" and time-saving appliances have been introduced to increase production. The shops are equipped with electric motors using hydro power, and a spur from the G. T. R. runs through the yard to the machine shop, bringing the forgings right up to the door. The forgings are stored just outside, and the cutting-off machines are located at that end of the shop within a short distance of the pile.

Cutting Off to Length.

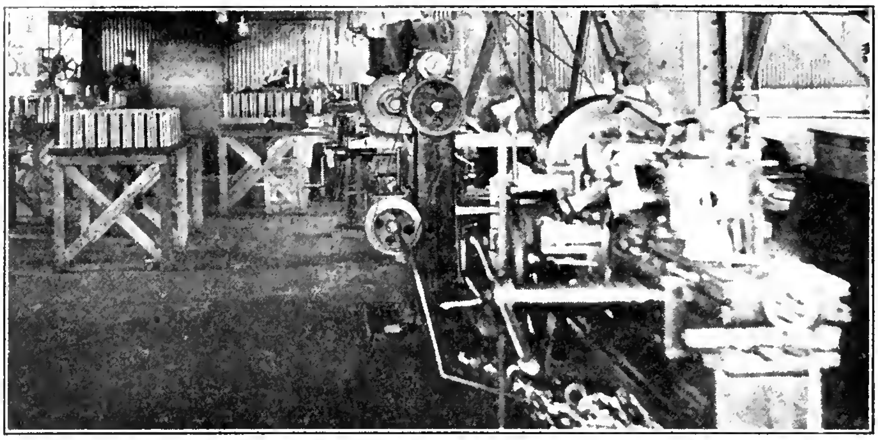
The machining of the shell forging begins at the base, which is cut to length on a cutting-off machine supplied by John H. Hall & Son, Brantford, Ont. The advantage obtained by machining the base first before cutting off the open end is that it gives a square face to work to for the later operation, and also has the advantage of keeping the length of forging in a definite relation to the thickness of base. The machine is equipped with a universal chuck for holding the shell, and a bar stop inside the headstock spindle locates the forging in the correct position. The stop, of course, comes up against the base of the shell inside. On the bed of the machine is a saddle, on which are mounted two cross slides, with holder on each, front and back. The cross slides are operated by a spindle threaded right and left-hand respectively, so that the tools always feed in when cutting. The back tool is set slightly ahead of the front,

PART OF MAIN FLOOR OF SHELL SHOP SHOWING MACHINES' LOCATION FOR FIRST SERIES OF OPERATIONS.

thus allowing a heavy cut being taken off. The hand screw at the right side traverses the saddle longitudinally.

Cutting Off Open End.

The open end of shell is cut off on the same type of machine as described above, the only difference being a shorter bar stop in the headstock and different cutting tools. The shell forging is placed in the chuck, the base end being up against the bar stop; the chuck is then tightened up. Both tool holders are used as in the previous operation, but in this case the parting tools are set in line with one another, the back tool being inverted to bring the cutting edge central. The shell forging is now the approximate length and ready for the body rough turned.

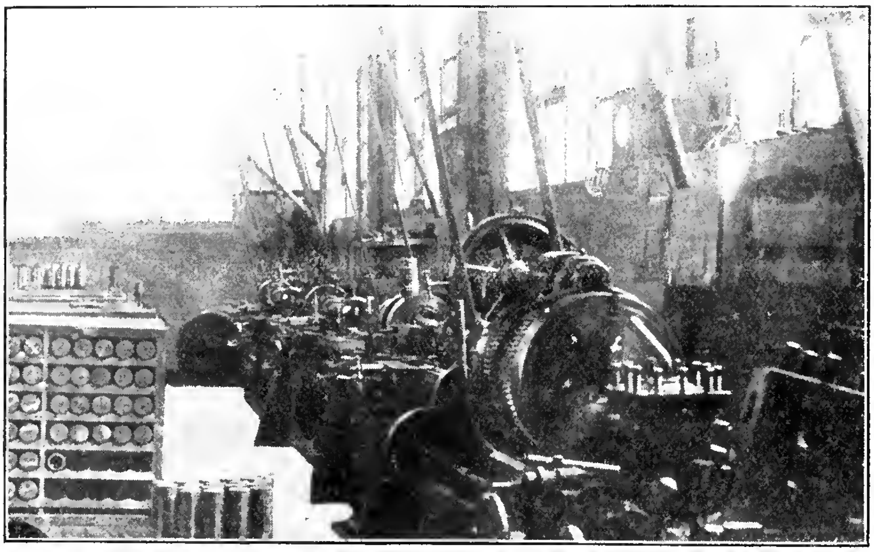


SHELL SHOP GALLERY SHOWING ASSEMBLY.

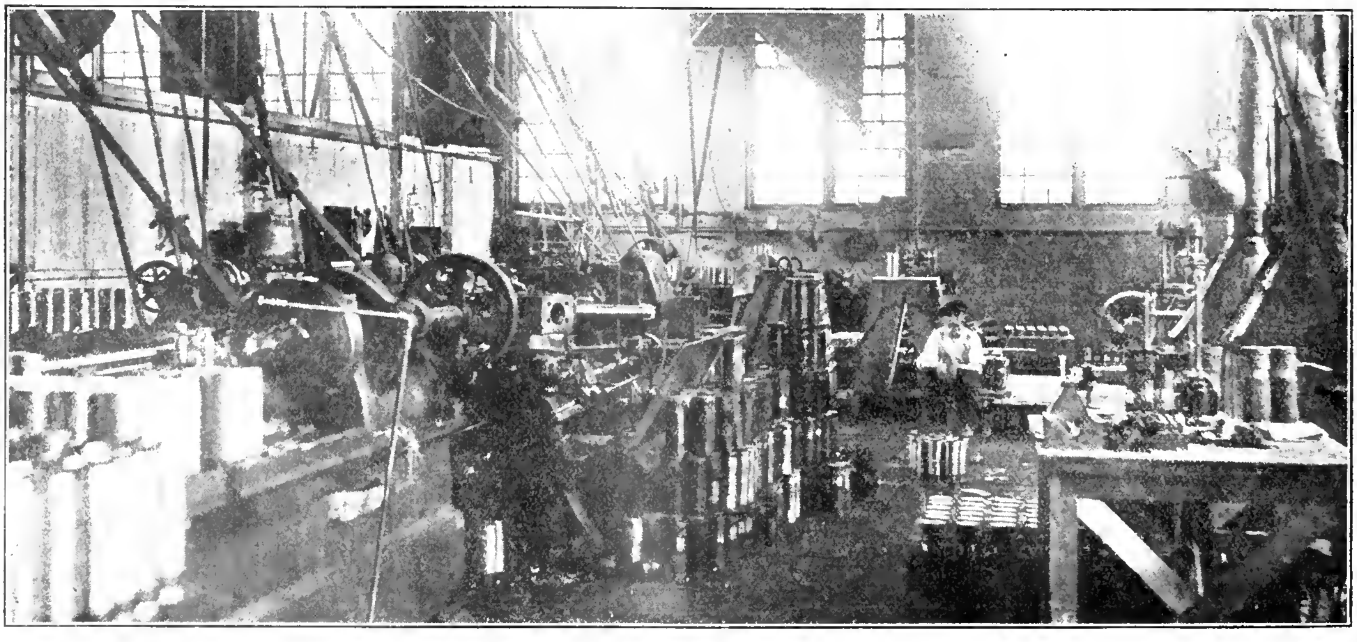
Rough Turning Body and Facing Up Base.

At the next operation the body is rough turned, the base faced up and corner rounded off, and the body up to the driving band groove finished. Two "Bertram" engine lathes are installed for this work, each being tooled up in identically the same manner. In order to have the outside of forging concentric with the inside, the shell is held on a mandril with a draw-back mechanism. The open end is also gripped in a universal chuck, which rotates the shell by means of a ring attached to the latter by three set screws.

On the cross slide is mounted a specially-designed fixture for holding the three tools for performing the operation. Two of the tools are set in line with the side of the shell and the third behind the base. The first tool held in an ordinary tool-holder rough turns the body of the shell for a distance of about 7 5/16 in. from the base, leaving the nose bevel to be machined later. The second tool, also at the side, is used for finishing the shell from the base to the driving band groove. This tool is held in a special holder, and can be moved back from the work at the end of the cut. The third tool is a broad cutter so formed that, while the base is being finished, the corner is rounded off at the same time. This tool is, as has already been stated, lo-



CORNER OF SHELL SHOP, SHOWING "WAVING" AND FINISHING LATHES.



SHELL SHOP, MAIN FLOOR, BEFORE HEAT TREATING DEPARTMENT WAS MOVED TO A SEPARATE BUILDING.

cated behind the base of shell, and is shown at the right in the illustration.

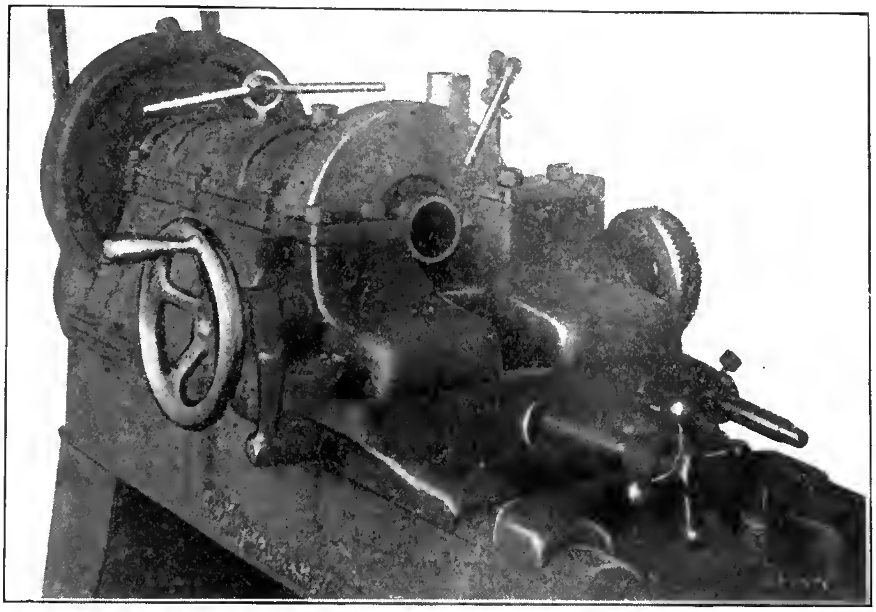
Machining Powder Pocket, Diaphragm Seat and Outside Nose Bevel.

This, the first operation on the inside of the shell, is performed on a "Warner & Swasey" turret lathe, the turret holding the tools for the inside work, while a tool holder on the cross slide contains three tools for machining the outside of nose. The shell is held in a universal chuck, which has a bush inside conforming to the shape of the shell base, and is used for locating the shell in the required position for machining. In this case it is immaterial whether the outside or inside work is done first. The usual method of procedure, and done in order to save time, is to reverse the order for each shell—that is to say, if the nose bevel was formed last on one shell it would be the first operation on the next, with the same rotation for the powder pocket, etc. By this means, one setting of the tools does for two shells. As an illustration the inside boring will be described first.

On the first turret face is a boring bar with a cutter for roughing out the powder pocket and diaphragm seat. The second boring bar has a cutter of similar shape, conforming to the profile of inside base of shell, for finishing the powder pocket and diaphragm seat. The inside work at the base is now finished and the turret is moved back out of the way to permit of the nose bevel being formed. The tool holder on the cross slide contains three tools for rough turning the nose outside and cutting to length. It should be stated that the nose at this stage must be of a certain shape or bevel so that after the closing in operation it conforms to the required profile. The first tool cuts the shell to length, not, of course, the finished length, as this is done at a later operation. The second tool is a taper cutter for forming the bevelled part of nose behind the straight section at the front. This straight part is rough turned by the third tool. This operation is now completed, and when starting on the next shell, the nose bevel is machined first, followed by the powder pocket, etc.

Waving, Grooving and Undercutting.

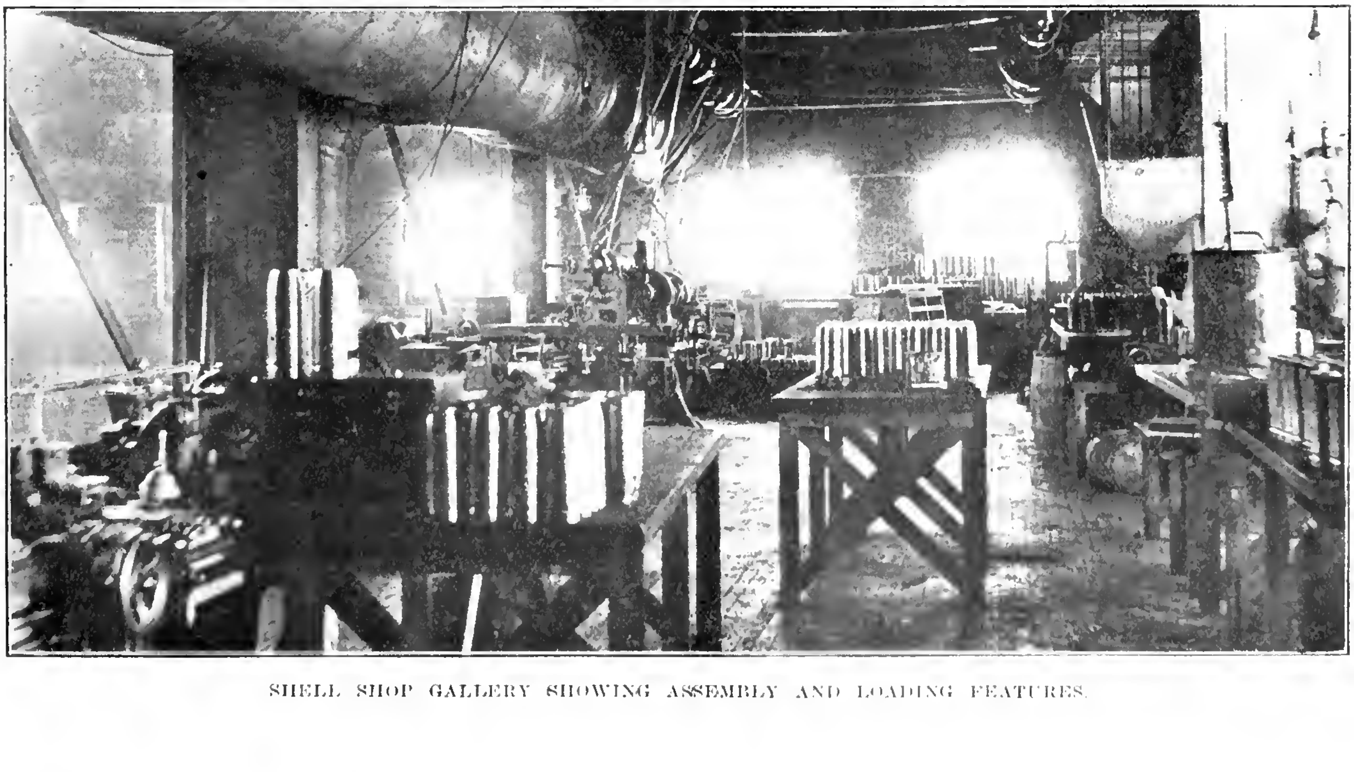
For this operation two engine lathes are installed, built respectively by the Canada Machine Corporation, Galt, Ont., and Flather & Co., Nashua, N.H. Both machines are equipped with a "Bertram" waving and undercutting attachment with a three-point cam, also a bar stop in the centre of chuck for fixing the position of the shell. The nose end of the shell is, of course, held in the chuck,



TRIMMING OPEN ENDS AND BASES OF SHELLS.

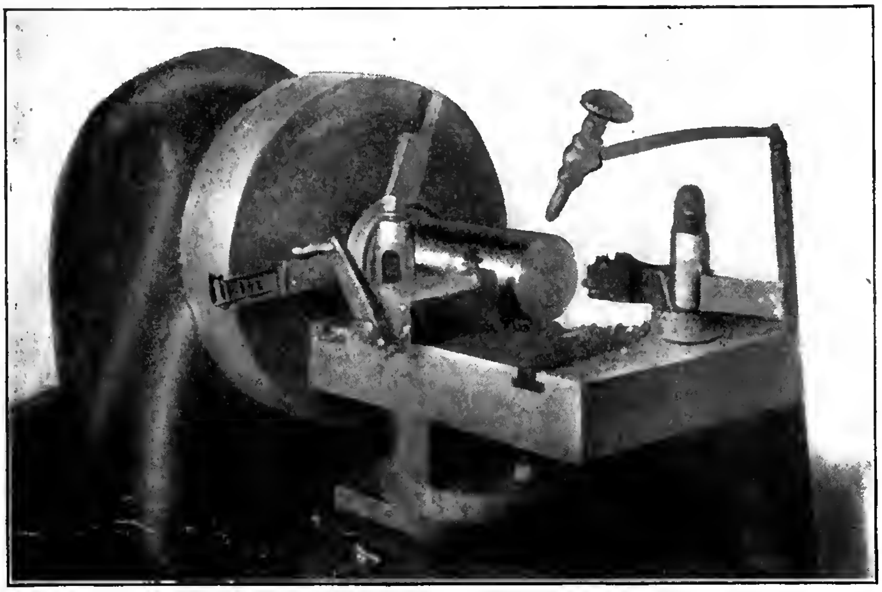
while the base is carried in a cup-shaped revolving centre on the tailstock mandril. The waving and grooving tool is situated in front, while the undercutting tools are at the back. All the tools are cutting at the same time, and the method of operation is as follows:—

The tool boxes are mounted on a fixture fastened to the lathe bed. The front tool is held in a specially-designed tool box mounted on a cross slide, the tool box working laterally in a slide. A



SHELL SHOP GALLERY SHOWING ASSEMBLY AND LOADING FEATURES.

bracket projects from the left-hand side of the tool box, and has a roller which is held up against the chuck cam by means of a strong spring at the right-hand side. The tool itself has a square face for cutting the groove with two



ROUGH TURNING SHRAPNEL SHELL BODIES.

vees for forming the wave lines. The undercutting fixture is mounted at the back, and has two tool holders, each having a hook-nosed tool. The tool holders work in diagonal slides in order to feed in at an angle to form the undercut. The tools are left and right-hand respectively and are inverted when cutting.

The feed is taken care of by cams on front and back brackets fastened to the lathe saddle. The cam on the inside of the front bracket engages with the cross slide of front tooling fixture, forcing the tool in as the saddle travels. The bracket at the back has two cams on the inside face, one for each of the undercutting tool holders. These cams also force the tools in as the saddle travels. The cam feeding in the waving tool operates on the cross slide underneath so as not to interfere with the oscillating motion of the tool box while the wave lines are being formed. This motion is imparted to the tool by the cam on chuck face.

Heat Treating.

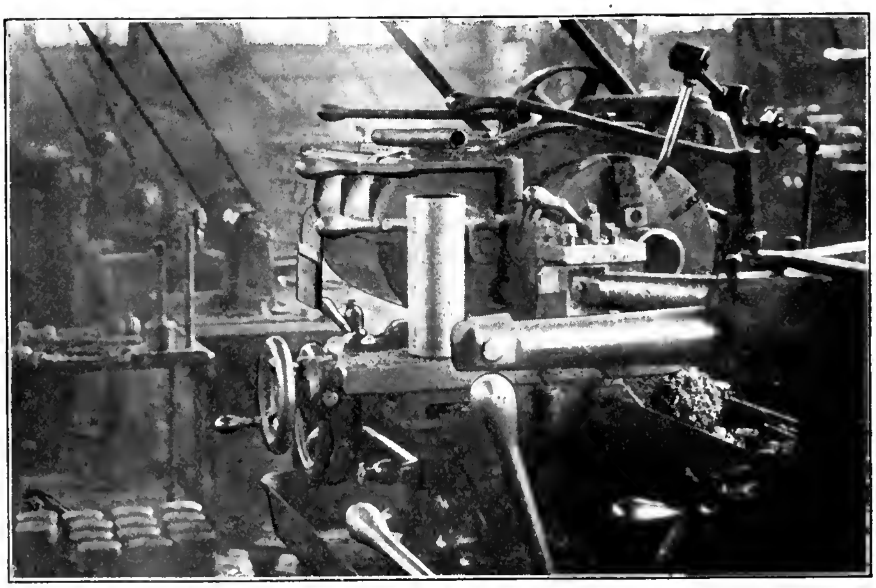
The heat-treating department is in a separate building adjoining the machine shop. In this shop is the nosing press and also the scleroscope testing bench; the furnaces are thus all together. There are four gas furnaces, not including the nosing furnaces installed—two for hardening and two for the drawing process. One furnace was supplied by the Tate-Jones Co., Pittsburgh, Pa., and the other three were built by the Collingwood Shipbuilding Co. The furnaces are heated by gas and air, no lead pot being used; the air is supplied at 2 lbs. pressure by a "Roots" rotary blower. The oil quenching tank is situated alongside the furnaces, and the oil in the tank is agitated by a belt-driven propeller to keep the oil cool. For the same purpose a number of coils with cold water circulating through them are fitted around the side of the tank on the inside.

The shells on coming from the machine shop are first of all hardened. They are heated in the furnace for about 20 minutes in a temperature of approximately 1,560 degrees Fah. They are then quenched in the oil tank and put on racks on the tank for a short time to dry. The shells are next drawn or tempered to produce the required degree of hardness. For tempering, the shells are heated in a gas furnace for about 12 minutes at a temperature around 800 degrees Fah. They are then cooled down gradually in a place free from draughts, the nose end standing in powdered lime. Previous to the drawing process, the shells are washed in a soda bath to remove the oil which clings to them after being quenched. A pyrometer, supplied by the Canadian Hoskins Co., Walkerville, Ont., is connected to all the furnaces in this department and indicates the temperature in each.

Scleroscope Test.

When sufficiently cool to handle, each shell is tested under a "Shore" scleroscope in order to ascertain the degree of hardness. By this means it is possible to tell the tensile strength of the metal, which should be approximately 80,000 pounds. The connection between the scleroscope readings and the tensile strength is that they bear a definite relation to each other, the degrees of hardness being proportional to the tensile strength of the metal. By keeping the hardness within certain limits it is possible to figure approximately what the tensile strength will be under test. This is definitely ascertained by having a test piece cut out of a shell and sent to a laboratory to be tested out on a testing machine. One shell is selected at random from each series of 120 and a suitably shaped test piece cut out of the shell at that part which has previously been tested on the scleroscope. The test piece is milled out on a milling machine supplied by the Ford-Smith Machine Co., Hamilton, Ont.

Before being tested on the scleroscope, the shells are cleaned on a polishing wheel, at the point to be tested, so that greater accuracy may be obtained in the readings. A number of the latter are taken at different points, the shell being turned round by the operator for this

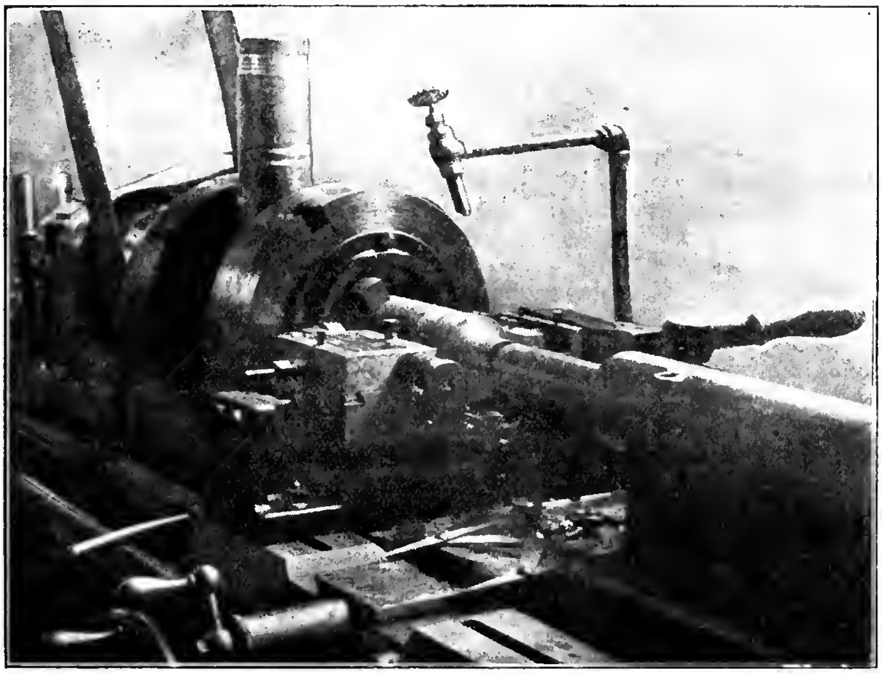


BORING POWDER POCKET AND DIAPHRAGM SEAT, FORMING OUTSIDE NOSE BEVEL.

purpose. All the shells are tested and afterwards arranged in their series.

Closing in Nose.

The nosing press is located in the heat treating department, the furnace being in line with the others and connected to the "Hoskins" pyrometer already referred to. The press was built by the Goldie & McCulloch Co., Galt, Ont., and is hydraulically operated. The lead pot is heated by gas and air, and is beside the press. The nose of the shell is heated to a dull red, then placed on the press, the steel diaphragm having been dropped in. The press is put in operation and the nose closed in by being forced up into the die at the upper end, thus closing in the nose. The shell is now taken off the press and allowed to cool slowly previous to being taken back to the machine shop.



"BERTRAM" WAVING, GROOVING AND UNDERCUTTING ATTACHMENT ON "C.M.C." LATHE.

Boring and Threading Nose, Inside and Outside Profiling.

The next operation consists of rough boring and reaming the nose preparatory to threading, forming inside profile behind the threads, rough turning nose profile outside, and cutting to length. The work is done in the foregoing order. Two engine lathes built by Flather Co., Nashua, N.H., are installed, each being equipped with a turret. After the shell is chucked, the nose is first of all rough bored by means of a cutter fixed in a boring bar held in the first turret face. A reamer now reams out the nose preparatory to threading. The third turret face holds a "Murchey" collapsible tap for threading the nose. The inside profile behind the threads is next formed by means of a forming cutter fixed to a bar held in the fourth turret face. The outside nose profile is then rough turned, a small cutter fixed in a boring bar being used. To obtain the correct profile, a roller is held in a piece projecting from the cross slide on which the turret is mounted. The roller engages with a small cam mounted on a bracket attached to the lathe bed, and, as the tool travels along, it follows the profile given by the cam. The sixth turret face holds a boring bar with a cutter for facing the shell to length.

Finish Body Turning.

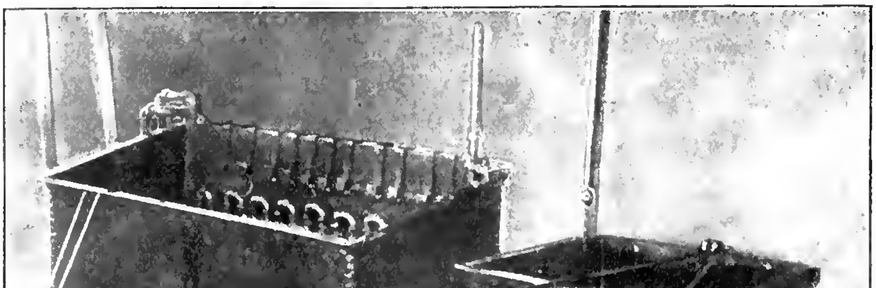
In this operation, a light cut is taken off the body and nose in a lathe and finished on a grinder. The shell is finished from the driving band groove to the end of the nose, the part behind the groove, it will be remembered, having already been finished. Three engine lathes are installed for this operation, two built by the "Canada Machinery Corporation" and one by "Flather & Co." All the lathes are fitted up in the same manner, having the same type of chuck and a forming cam under the cross slide.

The chuck is of special design and holds the base of shell behind the driving band groove. In the nose of shell is a threaded plug for the tailstock centre. A forming cam is fastened to the lathe bed under the cross slide, while a roller underneath the cross slide projects and engages with both faces of the cam. As the saddle travels, the turning tool follows the direction given by the cam, and thus forms the body of shell to the required profile.

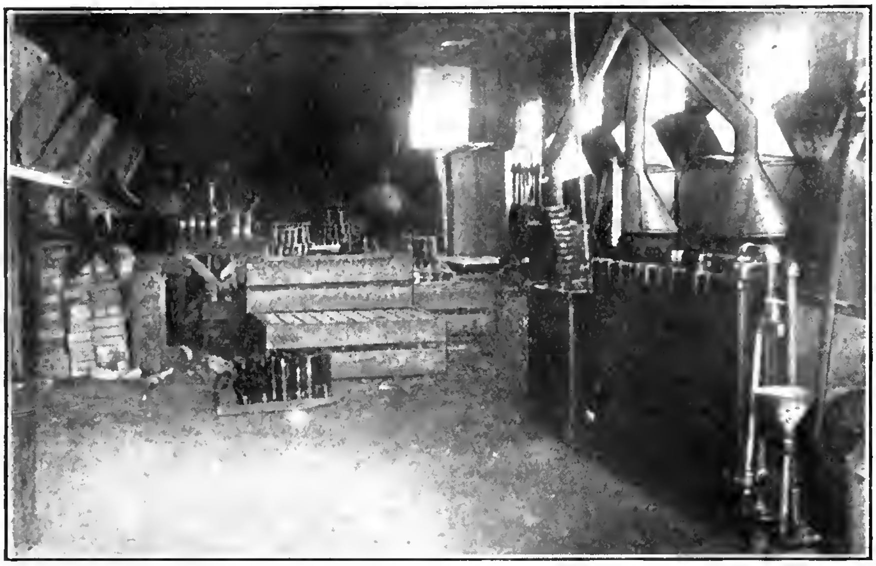
The shells are finished on a grinder built by the Ford-Smith Machine Co., Hamilton, Ont., the wheels being supplied by the Canadian Hart Wheels, Ltd., Hamilton, Ont. The base of shell is held in a chuck which has a locating stop for correct position, and the nose has the same plug screwed in as it had when being turned. The shell is ground from the driving band groove to the end of the nose at one operation, the grinding wheel being the same shape as the finished shell profile.

Copper Band Pressing and Turning.

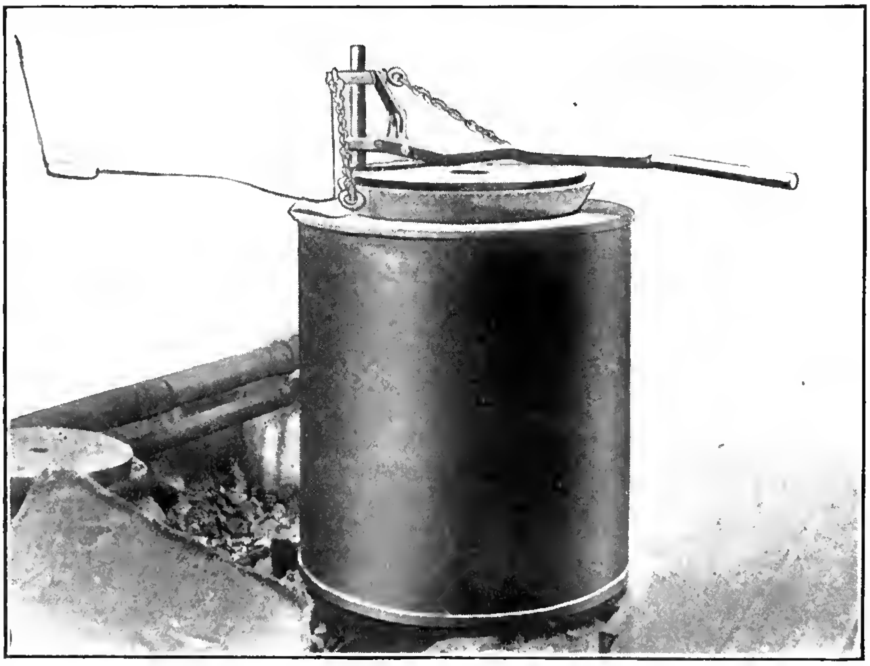
The shells now undergo a preliminary Government inspection preparatory to being taken to another department where the copper bands are pressed on and turned. The banding press was built by the "Goldie & McCulloch Co." and is operated hydraulically at a pressure of about 900 pounds per square inch. The press is of standard design, as used in many shell plants; a full description is,



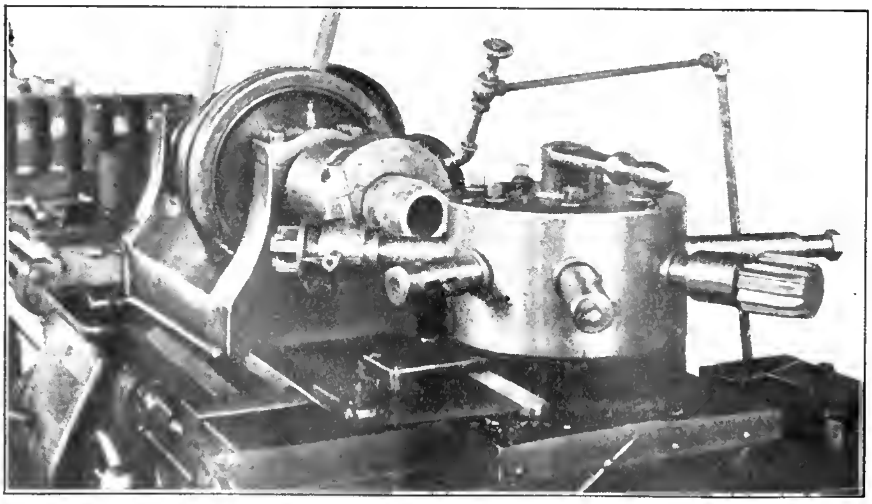
QUENCHING TANK TO LEFT AND SODA TANK ON RIGHT.



INTERIOR OF HEAT TREATING DEPARTMENT.



"TATE-JONES" GAS AND AIR FURNACE FOR SHELL-HARDENING OPERATION.



INSIDE PROFILING, THREADING AND FINISHING SHELL NOSE.

therefore, unnecessary at this juncture. In operation, the copper band is placed in the groove, the shell put on the press, and the pressure applied three times, the shell being moved around slightly after each. The band fills up the groove entirely, and is permanently in position.

The copper bands are turned on a "Warner & Swasey" turret lathe, which also has a cross slide for holding the turning tools. The turret holds a hollow centre which fits the nose of shells up to the shoulder, the centre revolving with the shell. This is the only purpose for which the turret is used. The base of shell is held securely in a collet chuck operated by a draw-back mechanism. The turning tools are mounted on the cross slide. The back tool makes the first cut, and the front tool then deepens the groove in the band, at the same time trimming the band at the edges. The back tool is set very low on the cross slide and cuts the band on the underside while travelling in a horizontal direction towards the operator, cutting the copper band as it passes underneath. This tool is of steel rolled to a special section to give the required form to the band, and only needs grinding on the cutting face to keep the cutting edge sharp. Above the back tool is mounted a gauge which projects over the work, and is used by the operator to place the back tool in the right position. The tool cannot be seen very clearly when cutting; for this reason the gauge, which is set in line with the tool, is used to place the latter in the correct position in relation to the band before beginning the cut. The front tool is set at the ordinary level, and is of special shape in order to deepen the groove in band and trim up the edges.

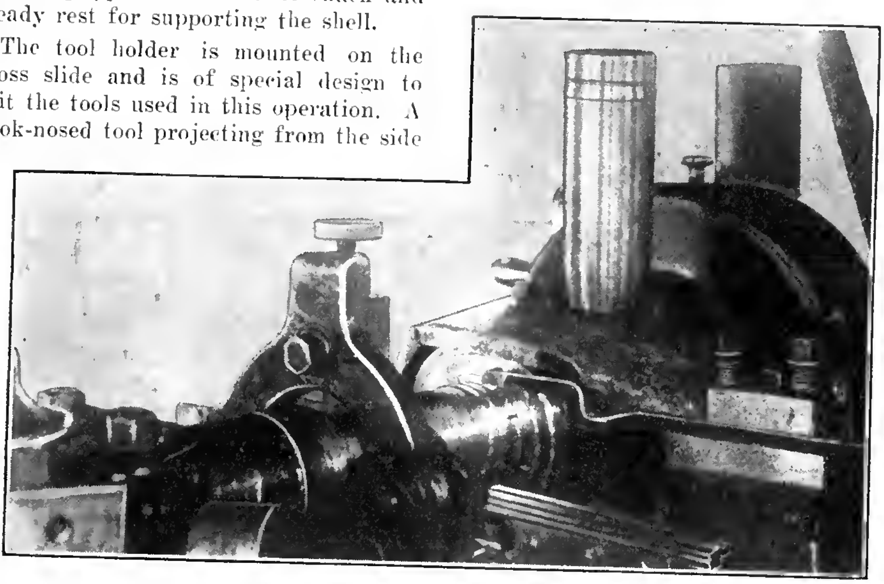
Assembling and Filling Shells.

When the shells arrive in the assembling department they are first of all hand-tapped at the nose. The tin powder cup is then slipped in past the diaphragm in the powder pocket, and the brass fuse tube screwed into the diaphragm. The shell is then placed under an overhead box or hopper containing bullets. The shell when being filled is placed on a mechanical jarring machine, which causes the bullets to settle down or consolidate. After being weighed and having had necessary adjustment made, the shells are taken over to the resin kettle and filled with hot resin, following which they are weighed again. The brass socket is then screwed into the nose, a "Chapman" ball bearing tightening nut being used for this operation. Afterwards the fuse tube is plugged with a small piece of rope, and soldered to the socket by an electric soldering iron.

Finishing Socket.

The brass socket which has been screwed into the shell nose is now finished on the outside, and the fuse seat formed. The sockets when they arrive at the plant are finished with the exception of the outside face. The fuse fixing screw hole has also been drilled and tapped. The socket finishing operation is performed on a "Flather" engine lathe, equipped with a collet chuck and steady rest for supporting the shell.

The tool holder is mounted on the cross slide and is of special design to suit the tools used in this operation. A hook-nosed tool projecting from the side of the tool holder faces up the end of the fuse tube in the socket, and at the corner of the tool holder on the front face is a small bevelled cutter which forms the socket to the same profile as nose of shell. To the right of this cutter and on the same face of tool holder is another cutter which forms the fuse seat outside the socket. After the end of fuse tube has been faced up, the tool holder is moved back into position for the other tools to be used and cross slide locked.

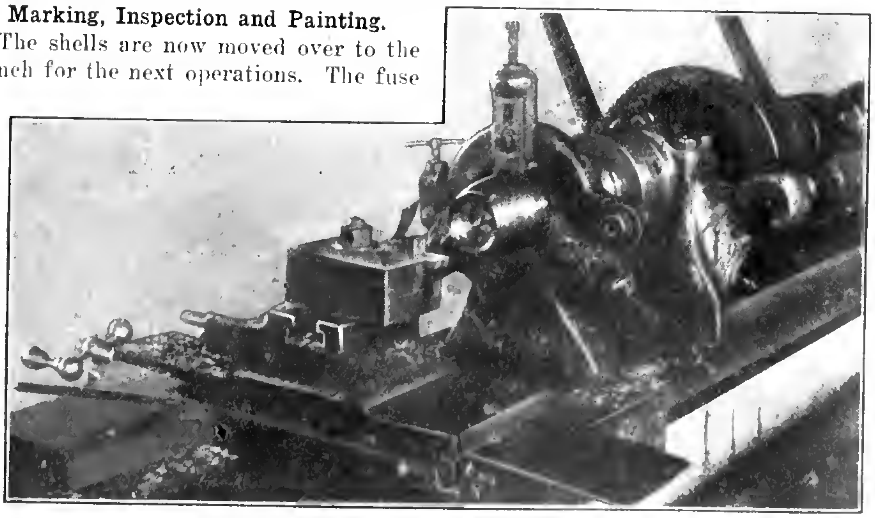


COPPER BAND TURNING.

Marking, Inspection and Painting.

The shells are now moved over to the bench for the next operations. The fuse tube hole is first reamed out with a "Hisey-Wolfe" portable air drill, and afterwards the socket and fixing screw hole are hand-tapped. The markings are put on by a "Holden-Morgan" marking machine. This is fixed on a bench, and is of the same type as is installed in several other, already described, shell plants.

After being cleaned inside with compressed air, the shells undergo the final Government inspection, during which they are weighed, gauged and carefully examined. They are then passed on to the painting department for the final operation. The painting machine consists of a cup-shaped holder on a bench attached to a vertical spindle under the bench. The spindle has a pulley attached to it, which is driven by a belt from the line shaft. While the holder is revolving, the shell is placed on it nose down and the paint applied by hand. In the centre of the holder is a spindle which goes up the fuse tube and helps to keep the shell steady while being painted. Two coats are applied, the first grey and the final coat black, the nose being painted red. When the shells are dry, a brass plug is screwed into the socket, the threads first being covered with a preparation called "luting." Packing for shipment constitutes the final operation.



FINISHING BRASS SOCKET AND FORMING FUSE SEAT.

OUR SEA POWER TRIUMPH

WRITING in the Daily Telegraph of August 18, Archibald Hurd says:

The sinking of the British transport Royal Edward in the Ægean Sea suggests not the failure but the triumph of our sea power. Not until the war is at an end will the British public realize the harassing burdens which the transport services have thrown on their Navy, which was not planned on a scale corresponding with the liabilities which were suddenly thrown on it in August, to be still further increased when it was decided to land an Expeditionary Force in the Gallipoli Peninsula

The submarine—failure as the blockade has proved—has been an embarrassment. A little over a year ago not a naval officer would, I believe, have contemplated without serious misgivings the various tasks which in the course of the war have been allotted to our naval forces.

Let no one exclaim, Why was not this particular transport better protected? That is the comment of the armchair critic, who, for his own reputation's sake, had better stick to his armchair, and not venture to sea. War consists of a series of incidents, some favorable to one side and some to the other, until the tally is complete—and then the balance is cast up, and the nation which has been the least injured is the victor.

A people which learnt in one day of the sinking of three large cruisers in the North Sea, which heard of the battleship Bulwark and the Princess Irene being reduced to nought by violent explosions, which received calmly the news of the sinking of the Ocean, Irresistible, Majestic, Triumph and Goliath, and did not lose its balance of mind when the Good Hope and Monmouth went down in honor off Coronel will not be dismayed by this latest blow.

It is a success to the enemy, but it represents no such failure to us as can exert any permanent check on our victorious movement against the foe. The ship! What does it matter? The lives? They are irreplaceable. For those who will be mourning in the next few days—after a period of anxious hopes and doubts—for the brave spirits offered up on the altar of the highest cause in which any country waged war, the sympathy not only of the nation but of the Empire will be poured out. They have died for us and those who will come after us.

The Production of Sound Ingots for Shell Requirements*

By Sir Robert A. Hadfield, F.R.S.

It is shown by the following detail of the research work carried out by the author during recent years that there is no necessity for unsound material being produced for either rail or shell purposes, slight, but highly important changes in procedure reducing losses to zero.

FIG. 1 represents two 18-in. ingots made by the Hadfield system, weighing about 2¾ tons each. These ingots were cast with the small end up, as in ordinary practice. The photograph is interesting, as it gives an excellent view of the cavity produced by the sound steel in these ingots as it settles down into the body of the ingot proper; that is, below the feeding head. In these ingots it is not necessary, in order to determine whether they are sound or not, that machining or other observation by mechanical methods should be carried out, and at least 88 per cent. to 90 per cent. of sound usable and saleable material is obtained.

Fig. 2 shows an ingot made in the present and ordinary manner; not even the most experienced expert could say whether the exterior of the ingot was sound or unsound, whereas the ingot in Fig. 1 shows the steel to have settled or sunk down. When steel so sinks it is a definite proof that the material is sound and free from blow-holes. The following results further illustrate this important advance in the production of sound steel:—

Measuring the Cavity.

To show how considerable is the cavity which forms in piping steel, nine 15-in. ingots were taken (weighing about 3,600 lbs. each), each of which had the sand head and the writer's method of feeding carried out on them. After the ingots had cooled down, the hollows or cavities in the sand heads were filled with water, then the water was poured out and carefully measured. Table I. shows the results obtained.

*Abstract of paper communicated to the Franklin Institute.

Table I.

Ingot Number.	Cubic inches.	Lbs. of Steel.	Percentage of weight of ingot.
1	457	128	3.57
2	549	154	4.30
3	457	138	3.57
4	457	128	3.57
5	472	132	3.68
6	488	137	3.82
7	518	145	3.05
8	579	162	4.52
9	488	137	3.82
Average	496	139	3.88
Maximum	579	162	4.52
Minimum	457	128	3.57

Weight of ingot, 3, 600 lbs.

The average weight for the nine 15-in. ingots showed that 139 lbs., with a minimum of 128 lbs. and a maximum of 162 lbs., passed from the head portion into the ingot itself. This percentage is represented by an average of 3.88 per cent. In other words, about 4 per cent., or 140 lbs. of of the total weight of the ingot or ingots cast passed from the upper or feeding head into the body of the ingot. Let it be assumed that the cubic capacity of each of the 15-in. ingots was approximately 12,500 cub. in. But for this feeding there would be a general want of solidity, chiefly at the upper portion of the ingot, to the extent of, say, 500 cub. in.—say, 4 per cent.—of the whole capacity. It is surely readily apparent why an ingot which is not fed must perforce be deficient in homogeneity.

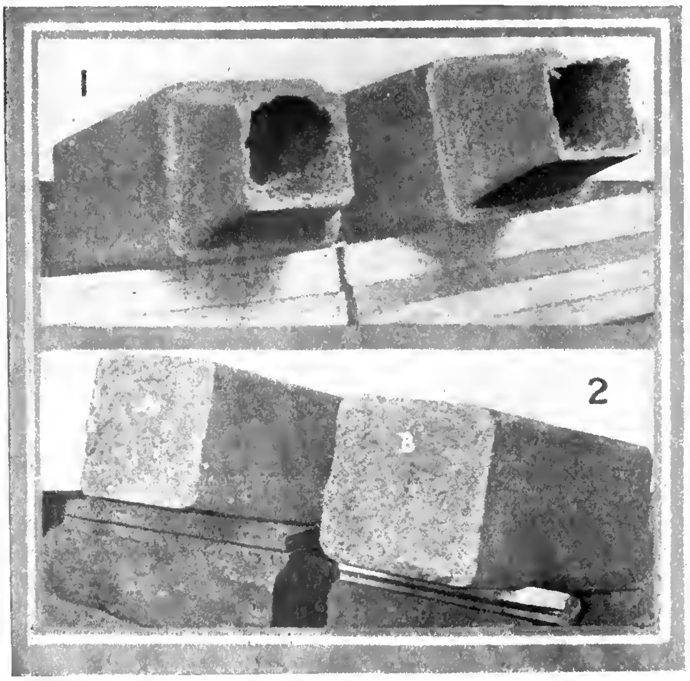


Fig. 1. 18-in. Ingots of about 2¾ tons made by the "Hadfield" process. Fig. 2. 18-in. ingots of about 2¼ tons. A—Unsound ingot. B—Piped ingot.

There is, of course, a certain amount of feeding effect from the steel in the upper portion of the ordinary ingot, but this is not done efficiently, as the steel quickly freezes on the outside of the mould and on the surface of the liquid steel exposed to the air. Moreover, there is always an uncertainty as to how good or how bad is the resulting material. In any case, as the steel solidifies in an ingot of this size, the natural law of contraction demands that about 500 cub. in. have to be dealt with on an ingot of the weight and size mentioned.

While the results necessarily vary slightly, because the sizes of the head portion nearest the top of the mould formed in sand are not always uniform in length, as the steel shrinks down slightly more on the outside in some cases than others, on the whole the maximum and minimum figures of 4½ and 3½ per cent. of the total weight of the ingot having passed from the head into the ingot itself show very uniform working; if the heads were absolutely the same depth in each case, there would be practically no difference. If not treated, the piping would have probably run down the ingot itself, requiring a discard of probably 25 to 33 per cent. Although water cannot be poured into the cavity of a red-hot ingot, yet the cavity can be determined in each ingot by a cursory examination while at a red or yellow heat, involving only a few seconds of time.

Upper Portion Defective.

While in ingots made in the ordinary way as above mentioned a certain amount of fluid steel passes from the upper portion to the lower, still in doing so, it is robbing the quality of the upper portion of the ingot itself, which has no fluid metal above it to feed or take the place and supply the deficiency thus created. It will readily be understood, therefore, why the upper portion of ingots is so seriously affected as regards their soundness, also why segregation occurs. This is shown in a remarkably clear manner by ingot B (fig. 4). The steel in the "fed" ingots being maintained fluid in the head portion continues to exercise its ferro-static pressure, whereas with ingots made in the ordinary way the ferro-static pressure on the centre portion of the ingot is so slight that it produces very little beneficial effect. Further, without the feeding head above the ingot proper, the outside of the ingot in the ordinary ingot mould becomes rapidly chilled and frozen, so that it cannot contribute its proper share to the feeding of the remaining portion of the ingot. It is not, therefore, to be wondered at that rails rolled from the A and B portions of an ingot made in the ordinary way are liable to unsoundness or piping, or both, and are also often full of impure segregated material. There would probably be more dangerous ingots but for the fact that the steel maker tries to avoid this type of steel, and aims to make steel which will not pipe when poured into the ingot. Nevertheless, he is still fighting against a natural law. If piping steel is checked or avoided, he runs the risk of producing unsound steel, especially in the upper portion of the ingot, more or less permeated with blowholes. Thus, owing to lack of feeding from the upper portion, the centre, or that portion on the axis line of the ingot, must be of inferior nature, as the piping characteristics persist for quite a long way down the ingot.

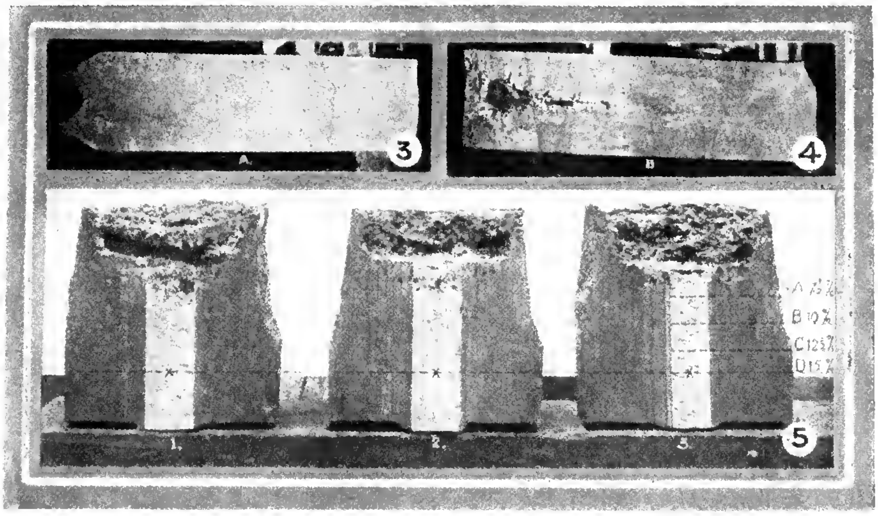


Fig. 3. Ingot made by "Hadfield" process; perfectly sound, free from blow holes, piping and segregation. Fig. 4. Ingot made in ordinary manner; unsound, having blow holes, piping and segregation. Fig. 5. Upper portions of three ingots made by the "Hadfield" process.

Ferro-Static Pressure Necessary.

This, as before mentioned, is for the reason that, owing to want of ferro-static pressure, the ingot lacks feeding from above, which, in the system of casting ingots now described, is maintained to a very late stage; that is, until or close upon actual solidification. There is always fluid steel in the upper portion of the ingot to feed the piping and shrinkage, both of which must occur, as they follow a natural law. Check or hinder ferro-static pressure, and segregation with its bad effects at once commences. In the case of "fed" ingots, the smaller amount of segregation which occurs takes place outside the ingot proper; that is, in the head.

The experiment, carried out by the writer some years ago, of pouring copper into the upper portion of an ingot 15 or 20 minutes after casting, showed how serious is this want of ferro-static pressure in the material situated on or near the centre or axis line of the ingot in ingots which have not been properly fed. The copper finds its way down to the bottom of the ingot, although added 15 minutes after casting. In any case, if there is no definite pipe at the bottom portion of such ingot, there is still material of loose or open structure, which means weak steel. Although this may not be apparent by fracture to the naked eye, nevertheless it exists, and can generally be detected by an examination of the micro-structure. In other words, notwithstanding that the product to be used may come from the lower half of the ingot, yet in unfed ingots it will be weak and not able to stand severe stresses.

It is true that some portions of the cavities in ingots have been measured, but probably not in the manner described by the writer. Although in the examination of the top of an ingot cast in the ordinary manner, and from steel which "settles" there is external evidence of some piping, this is irregular and varies considerably. Therefore, in the "best" ordinary ingot evidence is slight as to how much or how little the steel has piped.

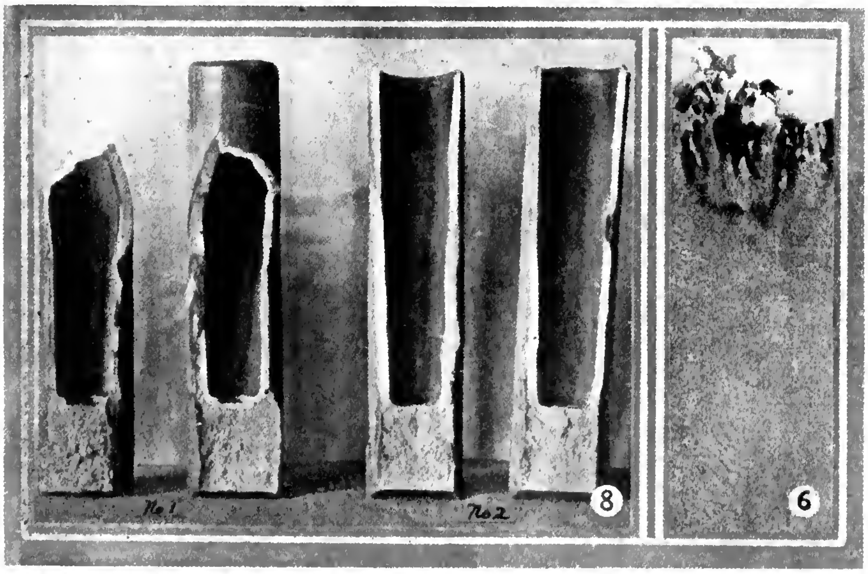


Fig. 6. Etching on axis line to determine amount of segregation. Fig. 8. Shell forgings from blanks (1) and (2) of Fig. 7, split open for inspection.

Kinds of Piping.

Dr. Dudley has pointed out that such piping is divided into two kinds: the upper, or what may be termed the visible pipe, and the lower or hidden pipe, the extent and character of which can be determined only by cutting open the ingot. In the ingots cast under the writer's system, all the cavity or pipe is open and can be rapidly inspected from

the top, its extent can be readily determined whether in the hot or cold condition. It is therefore not necessary to cut open the ingot.

Dr. G. K. Burgess, of the Bureau of Standards, Washington, is at present working with the writer on a joint research relating to this subject, and, though the full details of the work done cannot at the present time be given, it may be stated that ingots made under the writer's system were carefully cut up by the Bureau and compared with similar ingots produced at rail mills and made in the ordinary manner. The comparisons are shown in Figs. 3 and 4, in which A (Fig. 3) represents the ingot made under the writer's system, as described in the various papers, and B (Fig. 4) represents an average ingot made by one of the rail-makers.

Piping Defects Incurable.

While it is true that in unsound steel of very mild character the process of forging or rolling closes up the blowholes, and probably, if the heating temperature for rolling or forging is hot enough, the blowholes are welded together, even then it is doubtful whether such material can ever afterwards possess exactly the same tenacity and ductility as the same steel worked up from a sound ingot. In the case, however, of rail steel in which the carbon percentage is high, the same amount of welding does not take place; in fact, it is doubtful whether the blowholes are more than merely pressed together.

Sound Steel Imperative.

As large quantities of high-explosive steel shell are used by various governments, it is most necessary to obtain steel of the highest quality and yet at not too high cost. In other words, there is required steel of superior quality to that ordinarily used for rails, ship and boiler plates, angles, bars, etc. The system of manufacturing ingots of sound steel, described in the present paper, exactly meets these special requirements. Moreover, it can be used for making the comparatively lower quality of steel referred to. Several important governments, after making exhaustive tests, have been so satisfied with the Hadfield system of making sound ingots that, both for their land and sea services, they have now authorised explosive shell being made from ingots (afterwards forged into necessary billets) produced in the manner described in this paper.

As will be understood, an explosive shell, whether of small or large calibre, must be absolutely safe; that is, it must be (a) sound (that is, free from blowholes); (b) free from pipes; (c) free from segregation. Any flaw in the shell to its premature bursting would be most disastrous. In order to be absolutely certain of obtaining this combination of desirable qualities, it has been insisted upon by the user concerned that something like 40 per cent. to 50 per cent. of the ingot made in the ordinary manner—in fact sometimes more than this—must be discarded. Ingots made by the writer's method, however, are now allowed after discarding only 15 per cent.

It would also be quite possible under the system to give perfectly safe shell steel with only 10 per cent. to 12 per cent discard, and to ensure the qualities under the headings (a), (b) and (c) just referred to. This means a reduction in discard from 40 per cent. to 15 per cent. This decision has been arrived at after carefully cutting up and examining over one hundred ingots made by the Hadfield system, produced in the ordinary course of working. Each of these ingots on being cut up, was found to be perfectly sound.

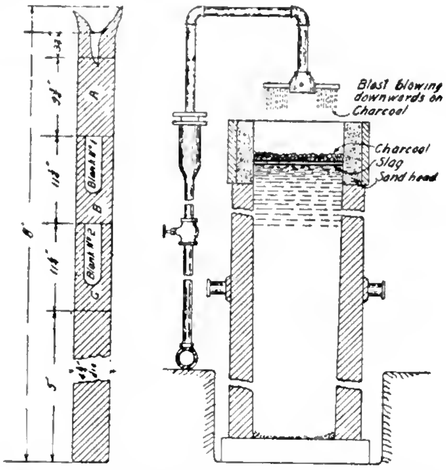


Fig. 7. Sketch showing upper portion of ingot forged and drawn out into a bar 4¾ in. diar. and about 8 ft. long. Fig. 9. Apparatus employed in producing sound ingots.

were not satisfactory the ingot would be rejected.

Ascertaining Soundness of Ingots.

The following demonstration was made to show the importance and efficiency of the system:—Fig. 5 shows the upper portion of three 15-in. ingots made under the Hadfield system. This place shows the soundness and freedom from piping of the ingots. If this is compared with the section of the ordinary rail ingot shown in B (Fig. 4), representing average and current practice, it will be seen how great is the difference. While sound material, whether rails or other articles, can be expected from ingots made as shown in Fig. 5, it can be well understood that if steel for explosive shell were made from an ordinary steel ingot cast in the usual manner, as shown in B (Fig. 4), there would have to be at least 50 per cent. discard in the ingot, and even then it is doubtful if the material could be safely used.

To further prove this, Fig. 6 shows an etching of the fractured portion of a 15-in. ingot (marked No. 3 in Fig. 5), on the centre or axis line, where segregation is usually met with to the greatest extent. This being so sound and free from segregation, it was necessary to continue the etching beyond the fractured portion. The analysis of this particular 15-in. ingot is shown in Table II. From this table it will be seen that there are no signs of segregation, unsoundness, or piping of any kind until the extraordinarily small discard of 7½ per cent. has been reached. Even in this case the difference in composition is very slight, whereas the composition of an ingot made in the ordinary manner and with only 7½ per cent. discard, to say nothing of the unsoundness, would show probably 0.60 to 0.70 per cent. carbon and 0.07 per cent. each of sulphur and phosphorus.

Table II.

	Analysis.				
	C.	Si.	S.	P.	Mn.
Original steel	0.36	0.19	0.031	0.031	0.96
A. Discard of 7½ per cent. (sand or feeding head of ingot)	0.54	—	0.056	0.031	—
B. Discard of 10 per cent.	0.46	—	0.040	0.031	—
C. Discard of 12½ per cent.	0.39	—	0.040	0.031	—
D. Discard of 15 per cent.	0.39	—	0.033	0.031	—
E. Bottom of ingot	0.38	0.19	0.031	0.031	0.96

It should be remembered that steel produce from the ingots to be used for the requirements of various governments is most critically examined by many inspectors supervising the material produced and the work done, not on the ingot only, but on each projectile, also including a considerable number of mechanical tests from each ingot, and from a certain number of projectiles made from each ingot. Moreover, each individual ingot is cut up and has to be passed on its own discard; if this

Table III. shows a number of analyses taken during the ordinary course of working) that is, they are not in any way special) from the centres of different ingots as above described, the drillings for analysis being taken exactly at the parting line where the 15-per cent. discard has been made. The figures obtained clearly show the important fact that the

steel is as pure and free from segregation at this part as it is at the bottom or at any other portion of the ingot.

As a further test, the following interesting experiment was made:—The portion of one of the ingots representing the usual 40 per cent. of the discard hitherto demanded in the manufacture of high-explosive shell was taken from an 11-in. ingot having the following analysis:—C, 0.38 per cent.; Si., 0.18 per cent.; S, 0.024 per cent.; P, 0.035 per cent.; Mn., 0.85 per cent. This was forged into bar 4¾ in. in diameter and about 8 ft. in length, as shown by Fig. 7. Projectiles were forged from this bar as indicated.

The length marked A is the portion of the material from the top part of the ingot head which, in the writer's system is cast in sand; that is, above the ingot itself. This portion, about 13 in. in length, and representing 7.1 per cent. of the discard, was cut off. Below this the projectile forging known as "Blank No. 1" was prepared, as shown by the dotted lines in Fig. 7. Below this, "Blank No. 2" was taken after 10.4 per cent. discard had been allowed. In other words, "Blank No. 1" was made from the material now not used (that is, after 7.1 per cent. of the whole ingot was discarded) and "Blank No. 2" after discarding 10.4 per cent. This is also not now used. The further and following blanks, No. 3, 4, and upwards, are not shown, because this is unnecessary, as such blanks then formed part of the current work. As will be seen, even "Blank No. 2" could also have been safely used.

It is remarkable to find that the fracture from "Blank No. 1" (that is, at the discard of only 7.1 per cent.) was perfectly sound, free from piping, and showed no signs of segregation. In the interior of the blank, after forging, there were some slight skin cracks proceeding from the hollow portion of the ingot top. The projectile from "Blank No. 2" was perfectly sound in every way, whether as regards surface fracture, freedom from segregation, piping, or any other defects; the interior was also perfectly sound. In other words, from this "Blank No. 2" (that is, with only 10.4 per cent. discard) a perfectly sound projectile was obtained.

The two projectiles from "Blanks Nos. 1 and 2" after being split open, are shown in Fig. 8. It will be seen that the fractures are sound, and that in each case, even including the blank from the portion of the ingot with only 7.1 per cent. discard, the material would have etched quite sound and free from segregation. The writer has now produced close upon 40,000 tons of ingots by the plan referred to in this paper.

Description of the Hadfield Process.

The following is a description of the author's method of casting steel ingots, castings, etc. which ensures soundness, freedom from piping, and absence of segregation: The process is illustrated in Fig. 9. As will be seen, it consists in heating the fluid steel in the upper part of the ingot or other mould, and maintaining it in a liquid condition by the combustion, in contact therewith, or in close proximity thereto, during the cooling and shrinkage of the metal in the lower part of the mould, of solid fuel, for example charcoal, by means of a blast of compressed air which is caused to impinge on the fuel while this is directly or indirectly supported by the metal below; and the interposition of a layer of fusible material, such as cupola slag, which has little or no injurious action on the metal, between the metal and the fuel. This slag largely prevents radiation of heat, the loss of which is much greater than is ordinarily supposed to be the case.

Table III.

	Analysis made by Hadfield of drillings from the usual ladle ingot tests.					Analysis made by the inspector from drillings taken from the centre or axis line of each ingot after cutting off 15% discard.				
No.	C.	Si.	S.	P.	Mn.	C.	Si.	S.	P.	Mn.
1229	0.40	0.22	.030	0.033	0.89	0.37	0.24	0.031	0.035	0.87
1231	0.38	0.21	.031	0.037	0.88	0.40	0.21	0.029	0.036	0.88
1233	0.40	0.21	.033	0.035	0.90	0.39	0.20	0.035	0.036	0.88
1234	0.39	0.21	.032	0.033	0.89	0.39	0.21	0.036	0.038	0.88
1243	0.40	0.26	.034	0.029	0.91	0.39	0.23	0.026	0.034	0.88
1244	0.38	0.23	.031	0.032	0.93	0.43	0.22	0.038	0.034	0.91
1245	0.39	0.25	.030	0.030	0.99	0.38	0.24	0.030	0.032	0.91
1246	0.40	0.21	.029	0.029	0.95	0.39	0.19	0.025	0.030	0.87
1247	0.37	0.19	.030	0.032	0.89	0.39	0.18	0.025	0.033	0.81
1248	0.41	0.20	.026	0.036	0.87	0.45	0.20	0.027	0.029	0.81

MUNITION METALS.

A PREPONDERANCE of raw material from which to manufacture munitions of war is of vital importance to a belligerent, and if, as many persons hope, the allies can maintain the advantage in this respect at the expense of the enemy, the raw material assumes a doubled value. Professor H. C. H. Carpenter, writing to "Nature," compares the resources of the different countries in munition metals, and sums up the position as follows:—

Belligerent Resources.

Of the ten munition metals, the enemy countries can certainly produce five without having resource to imports—namely, iron (the basis of the various steels used for war purposes), manganese, chromium, zinc, and lead; on the other hand, it is doubtful whether they can produce sufficient nickel, copper, aluminium, tin, and antimony from domestic ores. In view of the fact, however, that they prepared for this war with extreme care and foresight, it may safely be concluded that large stocks, either of ores or the corresponding metals or both, will have been accumulated in those countries.

However confident the higher German command may ostensibly have been of a rapid victory, they will quite certainly have laid their plans to wage a prolonged war if it should prove to be necessary, and such plans will have included the accumulation of munition ores and metal of which their countries produced an insufficient amount. There is, accordingly, no adequate reason for concluding that the enemy countries are likely—in spite of the prodigious scale upon which the war is being conducted—to run short of metals which are essential for war purposes for some time to come. Moreover, it may safely be concluded that their technical metallurgists will have been mobilized in the direction of discovering substitutes for any of the above metals of which a shortage is liable to occur in a long war.

The allies for their part can produce from their own resources all the iron, manganese, nickel, chromium, tin, and most of the aluminium they require; their command of the seas enables them to obtain, principally from the United States, their deficiencies in aluminium, copper, and lead; China furnishes the requisite antimony. Zinc is the only important munition metal of which there is a shortage, in spite of the great speed with which the American furnaces are being operated. Wherever it is possible to substitute another metal for zinc, it is of national importance that it should be done.

PROGRESS IN NEW EQUIPMENT

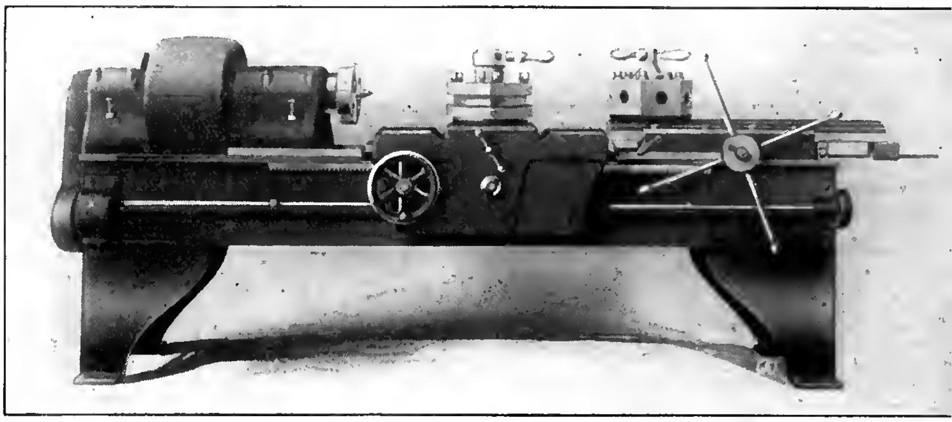
A Record of New and Improved Machinery and Accessories for the Machine, Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

SINGLE PURPOSE SHELL LATHE

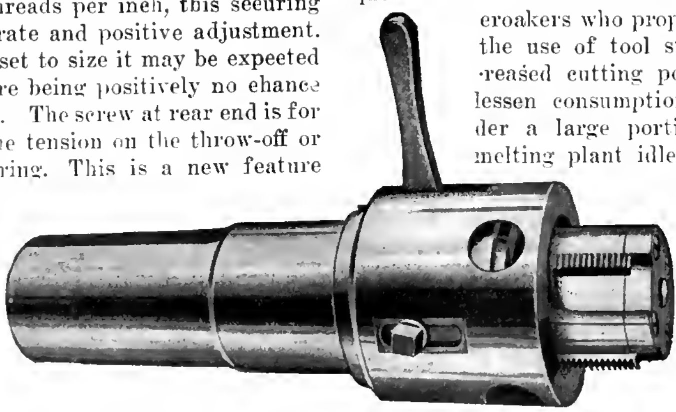
THE description and illustration refer to a new "Made in Canada" lathe which is being put on the market in response, we understand, to the demand for a heavy, sturdy tool with suitable attachments for producing the various machining operations required in shell work. This lathe is specially designed for the latter and is complete with all attachments necessary to rapid production of completely machined shells. Strength, rigidity, and weight, and a large swing just sufficient for the purpose for which it is designed, are the leading features of this product. The two sizes in which the lathe is to be built are reckoned to amply cover the requirements for machining shells up to and including 12 in., and the general scheme of manufacture is aimed to satisfy the present keen demand for quick delivery. The exclusive Canadian distributors of the lathes are Kellogg & Co., Traders Bank Building, Toronto.

COLLAPSIBLE TAP FOR SHELLS

THE accompanying cut shows the "Victor" collapsible tap which has been specially designed to tap shrapnel shells. It is made of a tough grade of machinery steel so as to stand the strain of hard usage. The tap is adjusted from the front end by means of a hardened setscrew, 32 threads per inch, this securing a fine, accurate and positive adjustment. When once set to size it may be expected to stay, there being positively no chance for slipping. The screw at rear end is for adjusting the tension on the throw-off or tripping spring. This is a new feature and a desirable one. All parts of the tap subject to wear are hardened and ground. The object in designing this tool was to make a tap that would cut threads accurately, and have sufficient strength and durability to make it an economical tool for the shell maker. The chasers are made of the best grade of high-speed steel; they are strong and heavy, and will stand the strain of threading shrapnel or high-explosive shells. This tap may be used in a turret head or attached to a live spindle, working satisfactorily in either condition. It is manufactured and sold by the Victor Tool Co., Waynesboro, Pa.



NEW SINGLE PURPOSE SHELL LATHE.



COLLAPSIBLE TAP FOR SHELLS.

THE ALLOYS OF HIGH-SPEED STEEL.

NO subject probably is receiving more attention in the steel trade of Sheffield to-day, says a correspondent of The Engineer, than that of alloys used for making high-speed steel. Since the discovery that certain rare metals gave to high-speed steel its essential property, and also the method of applying them successfully in manufacture, the trade in question has been revolutionized. The croakers who prophesied that the use of tool steels of increased cutting power would lessen consumption and render a large portion of the melting plant idle have been completely discredited. Although the modern variety of steel will do treble the work of the old, there has been a big increase of demand and output, and makers have enjoyed a measure of prosperity never dreamed of before.

Metallic Tungsten Production

With these facts in view, one can appreciate the anxiety that is felt on the subject of the supply of ingredients, without which high-speed steel cannot be produced. For metallic tungsten, the most important of them, the trade had for years relied upon the German metallurgical chemists to keep it supplied, but the war has taught it a sharp lesson in the necessity of being in a position to meet its own needs, or at any rate, not to be dependent upon a single source. Whatever happens in the future, it is certain that an adequate supply of tungsten is assured, and the question of whether Germany ever resumes its premier position in the manufacture of the alloy is of secondary importance. Germany may influence the market, but it will never again control supplies. Half a dozen works in England are engaged in its manufacture, several of them turning out the alloy in its metallic form, which is preferred by the local users.

The production of the latter is the great problem facing the trade. There is a large and ample output of ferro-tungsten, but to make the metal of the high standard of purity required in the form of metal necessitates much experiment and experience. Four firms are grappling with the problem. One of them is sending out considerable quantities. A second has supplied a small quantity of the right quality, and a steady increase is promised until a maximum of some 30 tons a month is reached. That, we believe, exceeds the output of any of the German works in the past. Hence on the completion of the experiments and developments now in hand, steel makers will be under no necessity to go outside the country to get supplied. The factor of price may, of course, arise, but there is no reason to doubt that British makers will be in a position eventually to hold their own against Germany even in this matter.

EXPLOSIVES AND GUNS.

THE establishment of factories in Canada to manufacture high explosives from raw material produced in the country, marks another step forward in the ammunition industry of this country. Cordite, which forms the propelling agency in British shells, is of special interest to thousands of Canadians engaged in shell making. This material gets its name from the form in which it is produced. It is a mixture of gun-cotton, nitro-glycerine and a mineral jelly. The jelly is employed to convert the gun-cotton into a plastic substance which can be squeezed or rolled into any form desired, but which becomes hard and horn-like when dried. When the material is in a suitable state it is put into presses which squirt it through dies of the required size suitable for any bore of rifle or gun.

Rifle cordite is produced in the form of a thin cord, and is wound on a reel; the thicker forms of cordite for guns are cut into suitable lengths. The final stage of manufacture is drying, which takes as long as two months in some cases.

John B. C. Kershaw, writing in Cassiers' Engineering Monthly, makes the following interesting statements on the subject of modern explosives:

The required muzzle velocities and pressures for rifles and guns can be obtained, with variations that are exceedingly small. Thus for rifles, the velocity prescribed is 2,380 foot-seconds with a plus or minus of only 40 feet, and a pressure of 19.5 tons with a maximum of 20 tons per square inch; for larger guns it may be 1,500 foot-seconds, and the pressure must not exceed 19 tons per square inch.

Application of Explosives in Warfare.

Great developments have occurred in the application of explosives to warfare during the last thirty years, for the introduction of elongated projectiles, rifled guns, and high explosives has practically revolutionized land and naval warfare. It is difficult to realize now that at the battle of Waterloo the effective range of cannon was less than 2-3rds of a mile, and that as solid iron balls were employed, the destructive effect of artillery fire was confined to the individual or building hit. One round from a modern field-gun firing a 3-inch shell, in fact, will do more material damage, and kill or wound more men, than twelve hours' firing with the form of cannon used in 1815. It is also a fact that when the Dardanelles were last forced by a British fleet (in 1807) the Turkish guns were firing stone shot, and that in Nelson's day, naval actions were rarely commenced at a range of more than one thousand yards.

Explosives are divided into two distinct classes known as "high" explosives and "low" explosives, the chief function of the latter in warfare being as a propellant, while that of the former is to destroy life and fortifications, by the shattering effects of the explosion, which occurs when they are detonated. "Low" explosives, as a general rule, are employed in the form of cartridges in order to generate a steadily increasing force in the chamber of the rifle or gun, sufficient to project and carry the bullet or shell to its mark. "High" explosives are employed in a casing or canister of steel, and are detonated either by a time-fuse, or by percussion on striking the ground or the object aimed at.

The weight of the shell differs according to the size of the gun; that fired from the ordinary 3-inch field-gun varies in weight from 15 to 18½ pounds. An explosive shell differs from shrapnel in that it contains no bullets, and the damage done by it to buildings and human beings, when the charge is detonated, is due to the force of the explosion and to the flying fragments of the steel case when it bursts. The detonator employed for high explosives is fulminate of mercury mixed with potassium chlorate and enclosed in a copper container.

Types of Guns.

The quick-firing 3-inch field-gun is the most important weapon used by the opposing forces, and it is estimated that Germany at one period of the war had 5,000 guns of this type in the field. The German gun is a converted breech-loader, and fires a 15-pound shell with a muzzle velocity of 1,525 feet per second. It is light and of simple construction, but possesses several disadvantages which render it a second-class gun.

The French 75-millimeter and the English 3-inch field-guns are of more modern type than the German gun; the rate of firing can be maintained at 20 rounds per minute, if desired, for a short period. The English gun fires a shell weighing 18½ pounds, whereas the French gun fires a shell of 15 pounds with a muzzle velocity of 1,740 feet per second. The Allies' 3-inch field-guns are superior, therefore, in range, accuracy and firing speed to the German guns, and it was only by their greater number that the Germans gained many of their successes in the early stages of the war.

It is reported that the Germans have developed a new type of field-gun which is fed automatically with shells on the machine-gun principle, and that this gun can fire double or treble the number of shells per minute that was possible with the older pattern. This new weapon, it is stated, will be used against the Allies on the Western battle front, and time will show how far the claims for the new gun are substantiated.

The Howitzer.

A howitzer, it may be explained, is the short, heavy type of gun used for throwing shells at a high angle in order that they may fall vertically into the enemies' lines or entrenchments with a high striking velocity. Both the Allies and the Germans have been making great use of this type of gun in their attacks in Flanders and Northern France. The British field howitzer fires a 4.5-inch 35-pound shell, and has a range of 3,400 yards. The German weapon of this class is 4 inches in diameter and fires a shell weighing 31 pounds with a muzzle velocity of 985 feet per second. The projectile fired by this latter howitzer is shrapnel charged with bullets embedded in tri-nitro-toluol, and this is the shell which has accounted for many casualties in the British and French lines.

The British army in addition to the light field-howitzer, possesses a heavier gun, throwing a 60-pound shell with a range of 9,500 yards; while opposed to this the Germans have a 6-inch howitzer throwing a 90-pound shell, and capable of firing at an elevation of 65 degrees. The range to which a shell carries is, of course, diminished as the angle of fire is increased above 45 degrees, and the object of firing at such an acute angle as 65 degrees is to obtain a steep angle of descent, and to ensure penetration of any overhead cover by the shell when it strikes the ground.

Although it is not generally recognized, it is a fact that the application of explosives to warfare in the past has tended to keep the opposing forces far apart, and to diminish the amount of hand-to-hand fighting. This tendency has resulted in diminished casualty lists in proportion to the numbers engaged in conflict, for it is only when engaged at close quarters in hand-to-hand fighting that the proportion of killed and wounded in armies can rise to fifty or more per cent.

This stage of warfare appears, however, to be passing away, and with the development of trench warfare and the use of poisonous gases, in addition to hand grenades and bombs filled with high explosives, we are once more confronted with conditions of combat which resemble those of earlier time. How far this development will proceed it is impossible to say. The powers of destruction that have been placed by the advances of science in man's hands are terribly effective, and it is quite possible that the limit has not even yet been reached.

Machinery Display at the Canadian National Exhibition

Staff Article

Machinery and supplies exhibited are particularly interesting in view of the peculiar conditions which have existed during the past year. Exhibitors are to be congratulated on their efforts to maintain the former high standard of equipment display. Progress in standard lines, and much that is new in special lines, are the two features which impress the visitor,

THE disturbing influence of the war is not so apparent as might be expected in the display of machinery and kindred equipment in the Machinery Hall and elsewhere at this year's Canadian National Exhibition in Toronto. A number of former exhibitors are unable to be present, but their places have been filled by several new comers, the variety of whose product augurs well for the future of the Canadian machinery industry.

Interesting Exhibits

The A. R. Williams Machinery Co. are to be found in their familiar location. Shell machinery and a "Williams" quick-firing field gun give quite a war-like atmosphere to the exhibit.

Cowan & Co. make their usual interesting exhibit of woodworking tools and machines, while the Preston Woodworking Machinery Co. show a tenoning machine in addition to their last year's products.

The Chapman Double Ball Bearing Co. exhibit a "Perrin" hydraulic pump and press in operation on actual shells destined for the battlefields in Europe. The Dodge Mfg. Co. are receiving visitors at their exhibit, which contains numerous examples of their widely-known products.

The Victor Saw Works, Hamilton, Ont., have two power hack saws working on shell material which make the exhibit attractive as well as instructive.

The Pratt & Whitney Co. show a special set of small tools for shell manufacture, while the Carter Welding Co. have a machine in operation, and carving armor plate quicker than the ordinary person can saw wood. L'Air Liquide Society again show the samples of work done by their apparatus in the welding and cutting metals.

At the Canadian Ice Machine Co. stand is a domestic ice box of ordinary proportions which is equipped with a complete automatic self-contained refrigerating plant of 1½ horse-power capacity in operation. A further anti-heat demonstration is in constant operation at the exhibit of the Armstrong Cork & Insulation Co., where the benefits due to the use of their "Nonpareil" Insulating Brick are made evident through the use of an electric furnace.

Belting exhibits are staged in an effective manner by the Dominion Belting Co., Hamilton, Ont., and D. K. McLaren, Ltd., Montreal, while the many excellent features of the Elliot Wood Worker are again demonstrated under actual conditions of use.

Machinery Hall

Armstrong Cork and Insulation Co., Toronto.—Electric furnace in operation, demonstrating insulating power of "Nonpareil" insulating brick, specimens of diatomaceous earth, cork products, etc.; models of insulated furnace settings. Representatives: G. C. Albertson, J. Kent.

Aylmer Pump and Scale Co., Aylmer, Ont.—Hand and power pumps, scale trucks, domestic water supply systems.

L'Air Liquide Society, Toronto.—Demonstrating oxy-acetylene welding: hand and power welding machines, acetylene generators, specimens of work, etc. Representatives: A. Turnbull, M. Harch, N. Smith.

Boiler Repair and Grate Bar Co., Toronto.—20th Century Grate Bars; "Coppus" Steam Turbo Blower for chimney draft. Representatives: C. W. Andrews, A. H. Hetts.

British Aluminum Co., Toronto.—Aluminum products, samples of bauxite, cryolite, aluminum powder for bombs, etc. Representative: E. Pannel.

Baines & Peckover, Toronto.—Exhibit of "Triumph Superb" tool steel: crucible, vanadium and cold rolled steel; expanded metal, babbitt metal, chain, wire rope, etc. Representatives: W. M. David, T. A. Steven, H. W. Marshall, A. McGregor, W. P. Williams.

The Canadian Automatic Wrench Co., Toronto.—"Dickson" automatic pipe and nut wrenches. Representatives: H. L. Dickson, J. Henderson, Fred C. Fowler.

Cowan & Co., Galt, Ont.—Two chain morticers, power feed rip saw, four side molding machine. Representatives: W. Cowan, S. F. Barrows.

Canadian Mill Supplies and Steam Specialties, Ltd., Toronto.—"Morehead" back to boiler system, United States graphite preparations, "Griscom-Russel" heaters and generators, "Everlasting" blow-off valves. Representatives: J. G. Abraham, L. O. Smith.

Cling Surface, Buffalo, N.Y. — Apparatus demonstrating the efficiency of slack belt drives when treated with "Cling Surface." Representative: J. B. Faatz.

Cleveland Pneumatic Tool Co., of Canada.—New Cleveland stope drills, portable foundry grinding machines, and a full line of pneumatic hammers, drills, riveters, Bowes and

CANADIAN NATIONAL EXHIBITION SHOWING SECTION IMMEDIATELY BEHIND MAIN ENTRANCE.

Neverleak couplings, etc. Representative: J. A. Day.

Canadian Ice Machine Co., Toronto.—Domestic refrigerating plant in operation, installed in Arctic refrigerator. Various sizes of York ice machines, apparatus and fittings, etc. Representatives: C. E. Allison, C. H. Bower.

Canadian General Fire Extinguisher Co., Toronto.—Demonstration of automatic sprinkler system in operation. Control apparatus for both wet and dry systems, sprinkler heads, fittings, etc. Representatives: W. Roos, W. Kay.

Carter Welding Co., Toronto.—Davis-Bowmanville oxy-acetylene apparatus, generators, blowpipes, armor plate cutting demonstration, etc. Representatives: H. W. Carter, P. Sorley.

Canadian Pneumatic Tool Co., Montreal — Pneumatic tools and fittings.

Geo. W. Cole Co., Torooto.—Cole heaters, boiler feeders and steam specialties. Representative: G. W. Cole.

Canada Machinery Corporation, Ltd., Galt, Ont.—Woodworking tools, viz: 48 in. band resaw, tenoning machine, 32 in. knife grinder, sash mortiser and relisher, hollow chisel mortiser, chain mortiser, New Pattern light variety saw bench, set of sample knives; ironworking tools, viz.: 36 in. vertical drill, 25 in. vertical drill, 24 in. backgeared crank shaper, No. 19 geared power press. Representatives: D. King, P. V. Burton, W. J. Irving, M. Preston.

Chapman Double Ball Bearing Co. of Canada, Ltd., Toronto.—"Chapman" elevating trucks for factories and warehouses. Shell machinery in operation. Complete line of ball bearings for all purposes. Illuminated display board. Representatives: W. J. Murray, C. M. Murray, W. C. Hockin and H. O. Edwards.

The Dodge Mfg. Co., Toronto.—Complete line of transmission machinery, including steel and wood pulleys, bearings, hangers, etc. Representative: J. F. Haas.

Dominion Belting Co., Hamilton, Ont. — Maple Leaf stitched cotton duck belting for power transmission and conveyors. Representative: J. Scott.

Len Edmonds, Smiths Falls, Ont. Maple sugar evaporators and supplies for the industry made by Small Brothers.

Elliot Wood Worker, Ltd., Toronto.—No. 3 machine with tilting table and graduated index plate for revolving, wood drilling machine, scroll saw and shaper. Representative: W. A. Elliot.

General Machinery Co., Toronto.—G.M.C. automatic water systems; demonstration of Luitweiler pumps. Representative: W. McLachlan.

G. Walter Green Co., Peterborough, Ont.—Woodworking machinery and saws.

The Holden Co., Montreal.—Complete line of portable electric and air tools, rock drills and railway supplies. Representative: J. B. Wilson.

The Hare Engineering Co., Toronto.—Full size installation, demonstrating the operation of the Fulton water-cooled mechanical stoker. Terry steam turbines, and Swartwout steam separators. Representative: J. F. Wood.

Jones & Glassco, Ltd., Montreal.—One 150 horsepower "Renold" silent chain drive, one 60 horsepower "Renold" roller chain drive.

Jones & Moore, Toronto.—Full line of electric motors, for 1, 2 and 3 phase and direct current. Shoe finishing machinery in operation. Representative: W. Dalton.

D. K. McLaren, Ltd., Montreal.—British oak tanned belting, D.K. balata belting, Philips pressed steel pulleys, D.K. wood pulleys, etc. Representative: W. S. Hamilton.

J. L. Morrison Co., Toronto.—Full line of bookbinders' and paper machinery. Representative: W. Doldring.

The Massey-Harris Co., Toronto.—Portable saw outfits, gasoline engines in operation, 1 No. 15 self governing grinder driven by gasoline engine. Representatives: B. Graham, N. A. McIntosh, A. Verity.

Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.—Special exhibit of small tools for high explosive and shrapnel shells, full line of milling cutters, taps, dies, drills, and reamers. Representatives: T. R. Whitehead, A. Webb.

Preston Woodworking Machine Co., Preston, Ont. Tenoning machine, power feed saw, 12 in. molder, 36 in. band saw, 24 in. panel planer, 36 in. high speed ball bearing shaper and Newport attachment for molding machines. Representatives: W. J. Murray, W. E. Near, A. M. Kerr.

Tallman Brass & Metal Co., Hamilton, Ont. Arctic antifriction metal, brass and aluminum ware and castings.

Twin City Oil Co., Berlin, Ont. Feed crushers in operation. Manzel oil pumps, and compressors. Representative: A. V. Phillips.

Victor Saw Works, Hamilton, Ont. Power hack saws operating on shell material, Victor saw blades. Representatives: W. F. Pollock, A. V. Wilson.

A. R. Williams Machinery Co., Toronto.—Boyd boring machine for high explosive shells, Chapman transfer truck, Holden Morgan thread milling machines, 14 inch Le Blond engine lathe, Reeves wood pulleys, marine gasoline engines, rowboat motors, etc. Representatives: Messrs. Cronk, Kiechel and McDonald.

GENERAL SECTION.

The Canadian Fairbanks-Morse Co., Toronto, are exhibiting in the agricultural machinery section oil and gasoline engines for electric lighting, pumping and general purposes, also marine engines. A 25-barrel "Midget" mill is in operation. Representative, G. Wheeler.

The Dennis Wire & Iron Works Co., London, Ont., located in the Process Building, have an interesting line of "Dennisteel" clothes lockers, filing cabinets, safe cabinets and steel stools. Representative, M. B. MacNeely.

Consumers Gas Co., Toronto, have two exhibits in the Process Building, one being devoted to a display of gas-hardening furnaces for tool room, also forging and soft metal furnaces. "Tyco" and "Taylor" recording pyrometers are also to be seen. Representative, H. E. G. Watson.

The International Time Recording Co. of Canada, Ltd., Toronto, are demonstrating in the Process Building cost systems and time clocks. Representatives, F. Mutton, L. B. Morton, H. B. Lukens and J. F. MacBride.

The W. S. Mahaffy Co., Toronto, are exhibiting in the Grand Stand Section the "Lifton" transporting truck, also a number of warehouse and factory trucks of various types. Representative, F. G. Mahaffy.

CANADIAN NATIONAL EXHIBITION SHOWING SECTION OF THE GROUNDS AND LAKE FRONT.

The James Morrison Brass Mfg. Co., Toronto, are exhibiting in the Process Building a full line of brass steam goods, including safety and reducing valves, gauges, locomotive injectors and valves, etc. Representatives, A. Betton and W. Dobbin.

W. A. Drummond & Co. are showing in the Grand Stand Section an extensive line of dairy and refrigerating machinery and supplies, including a 2 ton and $\frac{1}{4}$-ton machine, the latter being in operation. Representative, A. P. MacDonald.

S. F. Bowser & Co., Inc., Toronto, have exhibits in the Transportation and Process Buildings. These include gasoline and lubricating oil systems, "Red Sentry" pump for automobile and curb filling stations. Representatives, R. W. Williams, H. T. Stern and A. E. Moffatt.

A. H. Wynter-Joiner, Ltd., Toronto, are showing in the Transportation Building a full line of the well-known "Weston" portable electrical instruments. Representative, S. E. File.

The Tygard Rotary Engine Co., Toronto, are demonstrating in the Agricultural Machinery Section the "Tygard" rotary engine. Two units, 22 h.p. and 30 h.p., are being shown. Representatives, Professor James W. Tygard and F. G. Moore.

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WAR EFFECT ON MACHINE SHOP METHODS AND EQUIPMENT

IN the midst of numerous speculations as to the future of Canada's manufacturing industry, it may not be amiss to draw attention to the changed conditions under which in the coming time business problems will have to be approached and solved.

In a number of ways, the shell industry has been an eye-opener to us. Many firms which a year ago did but a limited business in machine work—iron founders, tinsmiths, structural workers and others, are now running a modern machine shop on most modern lines.

The requirements of a shop which must produce accurate work at a given figure, and also in a quantity, are understood more thoroughly now than ever before. Toolmakers are no longer frowned upon, the tool-room being recognized as something more than a mere luxury. The necessity for employing skilled help in maintaining output has been so borne in upon us that the application of scientific methods and labor-saving devices will be prosecuted with increased vigour when our manufacturing resources are again normally operated.

When such a time comes, there will doubtless be many who, having been fortunate in their selection of machines, will be able to adapt them to the more economical production of their various specialties. Plants which have installed automatic and semi-automatic machines, turret lathes, screw machines, etc., may be classed in this reckoning.

In competition with these, however, will be found others, and they may constitute a substantial majority, who, having a more varied assortment of equipment, evidenced their ingenuity in converting, adapting, and utilizing in numberless fearful and wonderful ways, anything that happened to be available. Regarding such, instances have come to light where machines by standard makers have been put to work on shell operations, the proper performance of which required, according to existent ideas, the utilization of complex machinery of ten times the value. Further, and as if to add insult to injury, the amount of tooling necessary was cut in half as a result of judicious experiment in methods and selection of materials, until the output of obscure machines became many times greater and was obtainable at a trifling cost.

When shells are a thing of the past, the activities of our plants will diverge and radiate in many directions. There will be a parting of the ways, and only balanced judgment will decide between success and failure—between a continued activity, rich in progress and development, and a helpless floundering in the mire of misdirected effort and inexperience. While naturally proud of our new, modern tool equipped plants, we must bear in mind that not a few other people have been using these same machines for years past, earning their living through them, and know just what they can do, and how much it costs to do it. Shell work may pay a fair return on the investment, but it offers no wide field of experience on different classes of work, either as regards materials or labor. The results obtained in shell manufacture indicate in moderate degree what may be accomplished in the direction of specialization of operations rather than of machines.

Specialization of equipment is exemplified by some recent productions in the United States where machines of the multiple type have been developed to a marked degree. The use of such machines, or even a tendency in that direction can, however, be justified only by a demand which would keep a sufficient number of them busy, and warrant the employment of the expert help necessary for maintaining their operation reliability and up-keep expense.

Our Manufacturers' Honor Roll

Representative of Canadian manufacturers, their families and administrative staffs who have heeded the call of Empire for active service on our various overseas contingents.

LIEUT. W. S. DREWRY,
E. L. Drewry, Ltd., Winnipeg.

MUNITIONS WORKER AND SOLDIER

SPEAKING recently at a meeting of emp loyees of Swan, Hunter & Wigham Richardson, Wallsend-on-Tyne, Dr. Hunter challenged the accuracy of the oft-repeated assertion that men in the factory were as useful as those at the front, and declared: "It is not true. A man at the front is twice as good as a man in the factory. These men are making sacrifices, and it will be a shame and a crime if, through any slackness on our part, even one of these brave lives is lost."

CAPT. H. C. TRENAMAN,
Domestic Specialty Co., Hamilton, Ont.

CAPT. G. D. McLAUCHLAN,
McLauchlan & Sons, Ltd., Owen Sound.

CAPTAIN J. STEWART GRAFTON,
Grafton & Co., Dundas, Ont.

LT.-COL. J. BRUCE PAYNE,
J. Bruce Payne, Ltd., Granby, Que.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey forge, Pittsburgh		$14 45
Lake Superior, charcoal, Chicago	.....	16.25
Ferro Nickel pig iron (Soo)	.....	25 00

	Montreal.	Toronto.
Middlesboro, No. 3	22 00	.....
Carron, special	23 00	.....
Carron, soft	23 00	.....
Cleveland, No. 3	22 00	.....
Clarence, No. 3	22 50	.....
Glengarnock	26 00	.....
Summerlee, No. 1	28 00	.....
Summerlee, No. 3	27 00	.....
Michigan charcoal iron.	26 00	.....
Victoria, No. 1	23 00	19 00
Victoria, No. 2X	22 00	19 00
Victoria, No. 2 plain..	22 00	19 00
Hamilton, No. 1	22 00	19 00
Hamilton, No. 2	22 00	19 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	2.20
Steel bars, f.o.b., Toronto	2.20
Common bar iron, f.o.b., Montreal	2.20
Steel bars, f.o.b., Montreal	2.20
Twisted reinforcing bars	2.20
Bessemer rails, heavy, at mill....	1.25
Steel bars, Pittsburgh	1.30
Tank plates, Pittsburgh	1.30
Beams and angles, Pittsburgh....	1.30
Steel hoops, Pittsburgh	1.40
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.10
Small shapes	2.35
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.90
Structural shapes	1.95
Plates	1.95

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, 1/4 to 1/2 in., 100 lb.	$2 35	$2 25
Heads, per 100 lb.	2 55	2 45
Tank plates, 3-16 in.	2 60	2 45

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$11 00	$11 75
Copper, crucible	12 00	12 50
Copper, unch-bled, heavy	12 00	12 50
Copper, wire, unch-bled..	13 00	13 50
No. 1 machine compos'n	11 00	11 00
No. 1 compos'n turnings.	9 00	9 00
No. 1 wrought iron	6 00	6 00
Heavy melting steel	7 00	7 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings....	11 00	11 00
No. 1 brass turnings....	9 00	9 00
Heavy lead	4 50	4 75
Tea lead	$ 3 25	$ 3 50
Scrap zinc	8 50	9 00

W. I. PIPE DISCOUNTS.

Following are Toronto jobbers' discounts on pipe in effect June 25, 1915:

	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
Standard				
1/4, 3/8 in.	63	32½	....	....
1/2 in	68	41½	....	....
3/4 to 1½ in. .	73	46½	....	....
2 in.	73	46½	69	42½
2½ to 4 in. ..	73	46½	72	45½
4½, 5, 6 in. ..	....	....	70	43½
7, 8, 10 in. ..	....	....	67	40½
X Strong P. E.				
1/4, 3/8 in.	56	32½	....	....
1/2 in.	63	39½	....	....
3/4 to 1½ in. ..	67	43½	....	....
2, 2½, 3 in. ..	68	44½	....	....
2 in.	....	....	63	39½
2½ to 4 in. ..	....	....	63	42½
4½, 5, 6 in. ..	....	....	66	42½
7, 8 in.	....	....	59	35½
XX Strong P. E.				
1/2 to 2 in.	44	20½	....	....
2½ to 6 in. ..	....	....	43	19½
7 to 8 in......	....	....	40	16½
Genuine Wrot Iron.				
3/8 in.	57	26½	....	....
1/2 in.	62	35½	....	....
3/4 to 1½ in. ..	67	40½	....	....
2 in.	67	40½	63	36½
2½, 3 in.	67	40½	66	39½
3½, 4 in.	....	....	66	39½
4½, 5, 6 in. ..	....	....	63	36½
7, 8 in.	....	....	60	33½

Wrought Nipples.	
4 in. and under	77½%
4½ in. and larger	72½%
4 in. and under, running thread.	57½%
Standard Couplings.	
4 in. and under	60%
4½ in. and larger	40%

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws....	65%
Sq. Head Set Screws	65 & 10%
Rd. & Fil. Head Cap Screws......	45%
Flat & But. Head Cap Screws....	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in. N.	70%
Semi-Fin. Nuts up to 1 in.	70%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

METALS.

	Montreal.	Toronto.
Lake copper, carload ...	$20 00	$19 50
Electrolytic copper	19 75	19 25
Castings, copper	19 00	19 00
Tin	40 00	39 00
Spelter	19 00	19 00
Lead	6 25	6 25
Antimony	40 00	40 00
Aluminum	40 00	40 00

Prices per 100 lbs.

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh...	$22 00
Openhearth billets, Pittsburgh..	22 00
Forging billets, Pittsburgh	28 00
Wire rods, Pittsburgh	25 50

NAILS AND SPIKES.

Standard steel wire nails, base	$2 40	$2 35
Cut nails	2 50	2 70
Miscellaneous wire nails..	75 per cent.	
Pressed spikes, 5/8 diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	75
Stove bolts	80
Plate washers	40
Machine bolts, 3/8 and less......	70
Machine bolts, 7-16 and over....	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass.....	35 p.c.
Nuts, square, all sizes..	4¼c per lb. off
Nuts, Hexagon, all sizes.	4¾c per lb. off
Iron rivets	72½ per cent.
Boiler rivets, base, 3/4-in. and larger	$3.25
Structural rivets, as above.......	3.25
Wood screws, flathead, bright	85, 10, 7½, 10 p.c. off
Wood screws, flathead, Brass	75 p.c. off
Wood screws, flathead, Bronze	70 p.c. off

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Standard. Price. per ft.	Extra Strong, Sizes Ins.	Extra Strong, Price per ft.	D. Ex. Strong, Size Ins.	D. Ex. Strong, Price per ft.
1/8in	$ .05½	1/8in	$ .12	1/2	$ .32
1/4in	.06	1/4in.	.07½	3/4	.35
3/8in	.06	3/8in	.07½	1	.37
1/2in	.08½	1/2in	.11	1¼	.52½
3/4in	.11½	3/4in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.....
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....

COKE AND COAL.

Solvay Foundry Coke	$5.75
Connellsville Foundry Coke	4.85-5.15
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

COLD DRAWN STEEL SHAFTING.

At mill	45%
At warehouse	40%

Discounts off new list. Warehouse price at Montreal and Toronto.

MISCELLANEOUS.

Solder, half-and-half	24.75
Putty, 100-lb. drums	2.70
Red dry lead, 100-lb. kegs, per cwt.	9.67
Glue, French medal, per lb.	0.18
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.18
Benzine, single bbls., per gal.	0.18
Pure turpentine, single bbls.	0.64
Linseed oil, raw, single bbls.	0.65
Linseed oil, boiled, single bbls.	0.68
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Lead wool, per lb.	0.10
Pure Manila rope	0.16
Transmission rope, Manila	0.20
Drilling cables, Manila	0.17
Lard oil, per gal.	0.73
Union thread cutting oil	0.60
Imperial quenching oil	0.35

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto 40%

PROOF COIL CHAIN.

1/4 inch	$8.00
5-16 inch	5.35
3/8 inch	4.60
7-16 inch	4.30
1/2 inch	4.05
9-16 inch	4.05
5/8 inch	3.90
3/4 inch	3.85
7/8 inch	3.65
1 inch	3.45

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1 1/2 in.	60
Carbon over 1 1/2 in.	25
High Speed	40
Blacksmith	60
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Centre	25
Pipe Reamers	80

Discounts off standard list.

IRON PIPE FITTINGS.

Canadian malleable, 35 per cent.; cast iron, 60; standard bushings, 60; headers, 60; flanged unions, 60; malleable bushings, 60; nipples, 75; malleable, lipped unions, 65.

TAPES.

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3.50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$3 00	$2 90
Canada plates, dull, 52 sheets	3 25	3 50
Canada Plates, all bright	4 40	4 60
Apollo brand, 10 3/4 oz. galvanized	6 40	5 95
Queen's Head, 28 B.W.G.	6 00	6 25
Fleur-de-Lis, 28 B. W. G.	5 75	5 75
Gorbal's Best, No. 28	6 50	6 50
Viking metal, No. 28	6 00	6 00
Colborne Crown, No. 28	5 38	5 30

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$11 00	.....
1 1/4 in.	11 00	.....
1 1/2 in.	11 00	.....
1 3/4 in.	11 00	.....
2 in.	11 50	9 20
2 1/4 in.	13 00	.....
2 1/2 in.	14 00	12 10
3 in.	16 00	12 70
3 1/4 in.	.....	13 90
3 1/2 in.	20 00	15 00
4 in.	25 50	18 90

Prices per 100 feet, Montreal and Toronto.

WASTE.

WHITE.	Cents per lb.
XXX Extra	0 11
X Grand	0 10 1/2
XLCR	0 09 3/4
X Empire	0 09
X Press	0 08 1/4
COLORED.	
Lion	0 07 1/2
Standard	0 06 3/4
Popular	0 06
Keen	0 05 1/2
WOOL PACKING.	
Arrow	0 16
Axle	0 11
Anvil	0 08
Anchor	0 07
WASHED WIPERS.	
Select White	0 08 1/2
Mixed Colored	0 06 1/4
Dark Colored	0 05 1/4

This list subject to trade discount for quantity.

BELTING RUBBER.

Standard	50%
Best grades	30%

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50%
Standard	50 & 10%
Cut leather lacing, No. 1	$1.20
Leather in sides	1.10

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	$9.00
1/4 in.	6.25
5-16 in.	4.65
3/8 in.	4.00
7-16 in.	4.00
1/2 in.	4.00

Prices per 100 lbs.

PLATING CHEMICALS.

Acid, boracic	$ .15
Acid, hydrochloric	.05
Acid, hydrofluoric	.06
Acid, Nitric	.10
Acid, sulphuric	.05
Ammonia, aqua	.08
Ammonium carbonate	.15
Ammonium chloride	.11
Ammonium hydrosulphuret	.35
Ammonium sulphate	.07
Arsenic, white	.10
Copper sulphate	.10
Cyanide of potassium (95 to 96%)	.35
Iron perchloride	.20
Lead acetate	.16
Nickel ammonium sulphate	.10
Nickel carbonate	.50
Nickel sulphate	.20
Potassium carbonate	.40
Potassium sulphide	.30
Silver chloride (per oz.)	.65
Silver nitrate (per oz.)	.45
Sodium bisulphite	.10
Sodium carbonate crystals	.04
Sodium cyanide	.35
Sodium hydrate	.04
Sodium hyposulphite (per 100 lbs.)	3.00
Sodium phosphate	.14
Tin chloride	.45
Zinc chloride	.20
Zinc sulphate	.08

Prices Per Lb. Unless Otherwise Stated.

ANODES.

Nickel	.47 to .52
Cobalt	1.75 to 2.00
Copper	.25 to .28
Tin	.45 to .50
Silver	.55 to .60
Zinc	.30 to .33

Prices Per Lb.

PLATING SUPPLIES.

Polishing wheels, felt	1.50 to 1.75
Polishing wheels, bullneck	.80
Emery in kegs	4 1/2 to .06
Pumice, ground	.05
Emery glue	.15 to .20
Tripoli composition	.04 to .06
Crocus composition	.04 to .06
Emery composition	.05 to .07
Rouge, silver	.25 to .50
Rouge, nickel and brass	.15 to .25

Prices Per Lb.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents

Montreal, Que., Aug. 30, 1915.—There is a firmer tone in the metal market, due to the fact that the demand is increasing without definite assurances of increased supplies. A general increase of $1 a ton is announced on pig iron and an increase of $1 a hundred on spelter. The demand for pig iron is fairly quiet, there being supplies available for all requirements.

High Speed Steel.

The high speed steel situation has reached a point that is looked upon by many as serious. It is becoming daily more difficult for dealers to fill orders, although some firms are fortunate in having a fairly large stock on hand. The representatives of one British firm are feeling very optimistic over the fact that they have a shipment on the ocean which will be due here shortly, but in this respect they seem to be entirely alone. It is freely prophesied that owing to the embargo against shipping steel from the Old Country containing tungsten or molybdenum the high speed steel situation here will become more and more acute, and two dollars a pound steel is looked for at a quite early date. In some cases larger-sized bars and unusual sizes have been re-rolled, but the amount of this additional supply of stock will not affect the situation to any extent. It would be wise for manufacturers to look into the future a little as far as their stock of high speed steel is concerned, and assure themselves that they will not have to suspend operations owing to the possible inability of securing a suitable supply.

A notable feature at present is that antimony which has been quoted around 40 cents has been steadily declining. There is little British antimony on the market, but recently it has become apparent that it is possible to secure fairly large quantities of Chinese and Japanese material. While 30 cents has been the figure quoted in the United States, this is even shaded at present by Montreal dealers. Another factor is also apparently affecting the situation, it being rumored that shrapnel bullets will be made in the near future without the use of antimony. A gentleman in close connection with the Government informed your representative that shrapnel bullets which were being tested by the Government were apparently giving most satisfactory results, and if these are adopted, the use of antimony will be eliminated from the manufacture of shrapnel shells altogether. This will have a tendency to depress the market still further. British antimony is scarce at 40 cents a pound, and Chinese and Japanese is quoted at from 27 to 29 cents.

Machine Tools and Supplies.

A striking indication of the scarcity of machine tools is illustrated by the fact that a Montreal firm have a large order for Canadian-made machine tools from Great Britain. Although they have made a special effort to fill it, so far they have been unable to get any quotations representing what would be considered a reasonable time for delivery. As far as the Montreal market is concerned, Canadian-made machine tools, except an occasional second-hand unit, are not to be had, and it is apparent that this condition will continue for some months to come. Some Montreal dealers are well supplied with second-hand tools, and a fair amount of new American machines; for these a good demand is reported.

Leather belting manufacturers report that the great scarcity of raw material has made it next to impossible to secure enough leather to enable them to fill orders. At the beginning of the war the saddlery manufacturers and boot and shoe dealers secured practically all the available stock, and in some instances were helped out by the leather belting manufacturers, who could now use large quantities to advantage, but are unable to secure same. There is demand for all kinds of small belting in connection with the manufacture of war munitions; in fact, this market is extremely active. The demand for small-sized belts is greater in Montreal than it has been for a great many years, and there seems no sign of a diminished activity along this line.

ALLIES' PURCHASING AGENTS.

The Trade and Commerce Department, Ottawa, has published the following list of purchasing agents for military purposes for the allied Governments:—

International Purchasing Commission, India House, Kingsway, London, Eng.

French.—Hudson Bay Co., 56 McGill Street, Montreal; Captain Lafoulloux, Hotel Brevort, New York; Direction de l'Intendance Ministere de la Guerre, Bordeaux, France; M. De la Chaume, 28 Broadway, Westminster, London.

Russian.—Messrs. S. Ruperti and Alexsieff, care Military Attache, Russian Embassy, Washington, D.C.

Toronto, Ont., Aug. 31.—It is generally believed that the British Government will continue to place orders for war equipment in Canada while the need lasts. The prospects for further improvement in business are therefore bright, more particularly with regard to the export trade. The indications point, especially in the West, to a heavy crop, which will have an exceedingly beneficial effect on business generally. There have been no developments of importance in the shell industry recently, but there appears to be little doubt that further orders will be placed, particularly for high explosive shells as soon as Canadian plants are in a position to turn out fixed ammunition. It is understood that David A. Thomas, the representative of the British Government, is favorably impressed with what he has seen during his investigations as to what can be done in Canada towards making shells.

With regard to domestic trade, conditions generally speaking are quiet, but considerably better than earlier in the year. The large increase in the export trade will no doubt in time have a stimulating effect in the domestic business. There has lately been a more active demand for agricultural implements and consequently a few iron foundries have been doing better business; the majority of plants, however, are feeling the effects of the depression. The building trade locally has picked up a little, but is still considerably below normal. Municipal work all over Canada has been very light this season on account of the difficulty in financing improvements.

Steel Market.

Conditions in the steel trade continue favorable, due to the increase in the export business and the large demand for bars and forgings for shells. The recent orders for railway cars have also created a demand for steel. It is announced that the Nova Seotia Steel & Coal Co. are working day and night on shell orders and are also making a large number of forgings for Clyde shipbuilders. Prices on all steel products are holding very firm although there are no changes to note this week.

The recent strength in the spelter market has had an unsettling effect on the sheet market, and prices are irregular. Following the decline in the spelter market, prices of sheets weakened, but are

now firmer, and some mills are refusing to quote for contract delivery because of the uncertainty of the price for spelter.

The high-speed tool steel situation shows no improvement and prices for the finer grades of tool steel have advanced again due to the increasing cost of tungsten and scarcity of supplies.

Conditions in the steel trade in the States continue very active. The heavy demand for steel rounds for shells is the leading feature, and specifications are coming in so fast that the mills are getting further behind on deliveries, notwithstanding the heavy shipments. Prices on bars and shapes are firmer, and some business is being done at 1.35c Pittsburgh.

Pig Iron.

Pig iron prices in the States have advanced in all markets, grey forge being now quoted at $14.45 Pittsburgh. The situation locally has not changed materially and the demand for foundry iron is light. Hamilton and Victoria brands are unchanged at $19.

Scrap Metals.

Prices on various scrap metals are unchanged with the exception of heavy melting steel, which has declined and is now quoted at $7; this is accounted for by an excess of supply over demand. Copper and brass scrap are in good demand and the market is firm.

Machine Tools.

There is no change in the situation, the demand for new tools is less active, but deliveries are no better. Prospective shell manufacturers are in many cases keeping out of the market until more orders for shells are distributed. Some firms already engaged in producing shells are buying tools from time to time to readjust their plants, or for extensions. There is a good demand for second-hand tools, and deliveries are better on this class of equipment, especially for lathes.

Supplies.

A brisk demand for small tools such as cutters, dies, taps, etc., is reported, and good business is being done in almost all lines of machine shop supplies. An advance in the prices of waste has been made, varying from ¼c to ¾c per pound. The new prices are given in the selected market quotations. The increased cost of raw stock is the reason for higher prices.

Metals.

The feature of the market this week is the recovery of spelter following heavy buying. Although there is a good demand, indications point to an attempt by sellers to advance the market. The tin market is unsettled with a weak tendency. The copper market is unsettled, and prices are slightly higher. Lead is stronger and aluminum are quiet and firm at unchanged quotations. There is a good demand for metal for munitions, but ordinary business is only moderate.

Tin.—The New York market is dull and unsettled with a weak tendency. This dullness is caused by the failure of the London market to advance in this metal in proportion to copper and spelter. Local quotations are unchanged at 19c per pound.

Copper.—The market is unsettled and the situation uncertain owing to prices being advanced for no apparent reason. Copper consumers have been out of the market for some time and a buying movement may follow as a result. The market has advanced ½c locally, and lake copper is being quoted at 19c per pound.

Spelter.—The market has re-acted and prices are higher, some large orders having been placed in New York for prompt and early delivery. The market is excited and indications point to manipulation. The advance is 3c locally at a nominal quotation of 19c per pound.

Lead.—The market is more active and lighter. The Trust has advanced their price to 4.90c New York. Locally lead has advanced ¼c and is quoted at 6¼c per pound.

Antimony.—The market is quiet but firm for future, and unsettled for spot delivery. Quotations are unchanged at 40c per pound.

Aluminum.—The market is quiet but firm and unchanged at 40c per pound.

CANADIAN GOVERNMENT PURCHASING COMMISSION.

The following gentlemen constitute the Commission appointed to make all purchases under the Dominion $100,000,000 war appropriation:—George Gault, Winnipeg; Henry Laporte, Montreal; A. E. Kemp, Toronto. Thomas Hilliard is secretary, and the commission headquarters are at Ottawa.

OCEAN TONNAGE SHORTAGE.

IT is said that an agreement has been reached between the Governments of Great Britain and Canada whereby the former will recognize the urgency of the situation and refrain as much as possible from commandeering ships that are needed for grain. So far as the ocean tonnage is concerned, however, the shortage is by no means so serious as has been claimed in some quarters; but while the passenger service has in some cases vanished, and in general has been reduced to a minimum, there has sprung up in its place a freight service that far surpasses any that Canada has owned in the past. The big liners have been replaced by large freighters.

Investigation has shown that at the present time the Cunard Company has four of these vessels, two of which have already visited the port of Montreal, although under changed names. This fact is also testified to by officials of Lloyds. In this way the absent passenger boats have to a considerable extent been replaced. That the available tonnage to carry grain will compare not altogether unfavorably with past years is illustrated by the fact that while the Victorian, one of the largest of the passenger boats (an Allan liner) could carry only about 4,000 tons of grain, the Monarch (one of the freighters replacing passenger ships) can accommodate between 8,000 and 9,000 tons. So, while the number of ships may be less, the carrying capacity will be much greater than has generally been believed.

MACHINE TOOL OPENING IN RUSSIA.

THE Department of Trade and Commerce, Ottawa is in receipt of a communication from the office of the High Commissioner for Canada at London, enclosing the name of an English firm, with connections in a number of the important centres of Europe, who desire to get into touch with a reliable Canadian merchant firm or manufacturing house to act as purchasing agents for machine tools and other plants. The firm in question has recently sold some machine tools to Russia for the manufacture of ammunition and have received additional inquiries for shell-making plant, but on account of the taking over of the English tool-makers by the English Government, it is not possible at present to offer English-made machines for some types of shells.

This English firm therefore would like to communicate with one large manufacturing house in Canada, which could supply the major part of the plant itself and get tenders for the remaining part, or else with a merchant house in Canada, who are thoroughly acquainted with the machine tool business and who could give them tenders for plant, getting the machines from the various manufacturers, with whom they are acquainted. Canadian firms, who may be interested in supplying the equipment that is asked for, will obtain the name and address of the firm in question, who are making the inquiry on behalf of their Russian clients, by applying to the Department of Trade and Commerce, Ottawa.

S. S. "ONTARIO NO. 2" TRIAL TRIP.

CAR ferry Ontario No. 2, which will ply between Cobourg and Port Charlotte in connection with the Grand Trunk Railway, made her initial trip, the builders' trial, on Saturday, Aug. 28, with about 200 guests aboard. The behavior of the new vessel was most satisfactory in every respect. The Ontario No. 2 was built and engined in Toronto at the yards of the Polson Iron Works, Ltd.

The new ferry is 318 feet long; beam moulded 54 feet; depth to main deck, 20 ft. 6 in.; draft loaded, 16 ft. 3 in.; tonnage, 5,400; horse-power, 4,500. She has two propellers, each driven by a jet condensing triple-expansion engine having cylinders 20½ in., 30 in. and 54 in. by 36-in. stroke, and making 110 r.p.m. The boilers are Scotch type, four in number, each being 14 ft. diameter by 12 ft. long, and giving a working pressure of 180 lbs. per sq. in.

Captain F. D. Forrest, Commodore of the Ontario Car Company's fleet, was at the helm, and W. H. Smith, manager of the company, represented Vice-President Kelly of Chicago, who was unable to be present. The new ferry will go into commission on October 1, taking the place of the car ferry Ontario No. 1, which will be laid up for the winter.

The new vessel has accommodation for thirty cars, each carrying seventy tons, also accommodation for one thousand passengers. The guests were entertained to a buffet luncheon. A Boy Scouts' pipe band provided music as the visitors inspected the various sections of the new vessel. Upon the return of the ferry to her moorings at the Polson Iron Works, Ltd., yards, a vote of thanks was tendered Col. J. B. Miller, president and general manager of the latter company.

Guests.

Among those on board, which included a large number of ladies, were: Col. J. B. Miller, W. H. Smith, J. W. Griemer, fleet engineer of the Ontario Car Ferry Co., and W. F. Crawford, the chief steward; Captain Harry Polson; William Newman, naval architect and works manager of the Polson Company, who superintended the construction of the new vessel; A. H. Jeffrey, A. E. Matthews, Captain W. J. Bassett, J. T. Mathews, Captain M. Corcoran, Mayor Church, Alderman Ramsden, Alderman Ryding, J. W. Somers, George Stevenson, Captain Evans, John Dodds; H. E. Wittenberg, General Superintendent, G. T. R.; W. H. Farrell, Superintendent of G. T. R. Terminals; E. C. Horning, District Passenger Agent, G. T. R.; Edmund Bristol, M.P.; W. C. Seeley, Master Mechanic of the Middle Division, G. T. R.; J. R. Leckie, Assistant Master Mechanic, G. T. R.; W. S. Wilson, Superintendent of Transportation, G. T. R.; W. Hamilton, L. Grabbel, Assistant General Baggage Agent, G. T. R.; J. D. O'Connor, J. W. McClintock, James Stewart, ex-Alderman James McCausland, Frank Ryding, Jack Edmunds, A. G. Webster, "Marine Engineering of Canada," etc.

Production of Shells in a Plant Specializing in Cut Gears

Staff Article

Resourcefulness in gripping and mastering the details of shrapnel shell manufacture has not, as will have been noticed from our leading articles in this and recent issues, been confined to any particular section of Canadian mechanical engineering enterprise. The plant here featured, although not a leader in point of size, earns that distinction in its output.

PREVIOUS to taking up the manufacture of shells, the plant described in this article had been devoted exclusively to the production of cut gears. While the gear-cutting machines themselves were of no use in shrapnel work, the larger part of the shop equipment fitted in very closely with the new requirements. Considerable additional machinery was installed, but it was almost all of the same kind as that already in use, and merely represented such extensions as an ambitious factory manager might hope to add to such a plant during the next two or three years. The hardening room, which department has given so many shell makers a full measure of trouble, did not in this case require any changes except the addition of a larger soda water boiler and a larger quenching tank with circulating coils for cooling water.

The organization of this plant is based on a production of one completed shell every three minutes. The exact sequence of operations on 18-pounder shrapnel varies somewhat according to available facilities, but in a broad sense the general grouping of operations is similar in most plants.

The preponderance of Jones & Lamson flat turret lathes in this shop will be noted, as well as the fact that a number of these are of the double spindle variety, finishing two shells at each revolution of the turret.

Referring to operation 1—cutting off—the machine in which this is done was designed and built by the Hamilton Gear & Machine Co., Toronto, and has been in demand from other shops since the shell business began to assume its present importance. The shell is encircled by an annular chuck with automatic jaws, which grip the shell body and leave both ends exposed. The shell is located by a stop rod, positioning from the inside of the base of the shell. Excess metal on the base of the forging is removed by one tool, while the open end is trimmed to the correct length by a cutting off tool. These tools are located on two separate slides, one on each side of the chuck, with different rates of feed (ratio about four to one) to suit their work. They thus automatically size the overall dimensions of the forgings. Owing to the great variation in the thickness of the bases of the rough forgings, it is sometimes necessary to take a very heavy cut, as much as five-eighths of an inch having been encountered. As indicated by the illustration, Fig. 1, ample belt power has been provided for this heavy work.

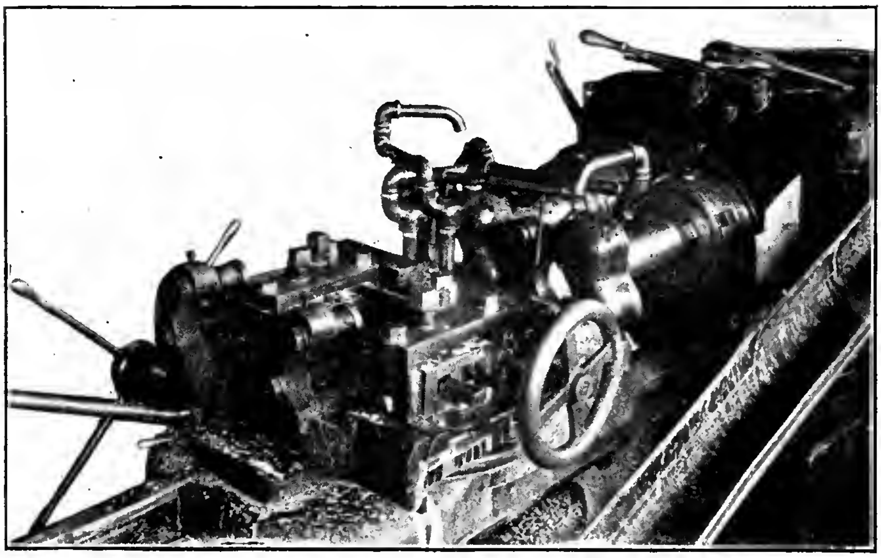


FIG. 2. DOUBLE SPINDLE LATHES EQUIPPED WITH UNIT TOOL BLOCKS.

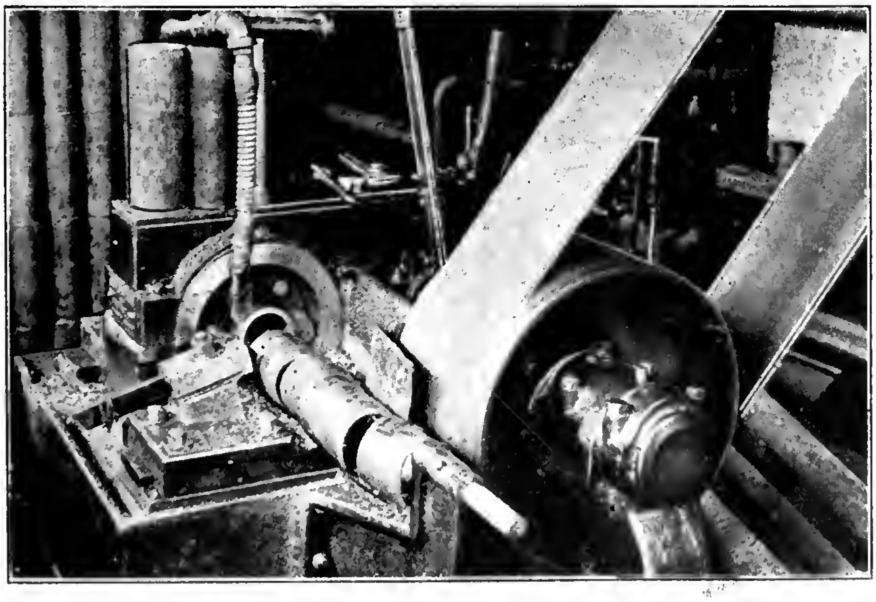


FIG. 1. "HAMILTON" CUTTING-OFF MACHINE.

Operation 2 includes rough turning the outside, finish face base, round off corner and machining groove. It is handled on two double spindle and one single spindle J. & L. flat turret lathes, size 3 in. x 36 in. The tool arrangement on these machines is decidedly interesting. That supplied by the machine builders was found capable of improvement, and a complete revision of the equipment resulted, as shown in Figs. 2 and 3.

The work of waving and undercutting the band groove has been concentrated on one single spindle machine, and the balance of the operations left to the other three machines of the battery, as mentioned above.

Unique Tooling

The gang tooling and the interchangeable unit tool blocks used on these machines are particularly interesting points, and are shown in Fig. 3. The three separate tools for finishing base,

rounding corner, and machining groove are shown in place, while on the right of the illustration the block is dismantled, showing separate rocking plates under each tool. These cutting tools are all maintained at standard angles and dimensions, and are kept in the tool room along with the tool-setting jig shown in the illustration. This jig is so constructed as to hold the tool block in the same relation to a dummy shell A (which is part of the jig), as it will bear to the work on the lathe. Spare blocks with the tools already set up are kept in the tool room ready for the lathe hands.

FIG. 3. UNIT TOOL BLOCK, ASSEMBLING JIG, AND COMPONENT PARTS.

The fixture used for cutting the dovetail in the band groove is rather unusual. It is shown in Fig. 4, from which it will be noted that both tools work from the same side and operate simultaneously. The shape of the tool holders is such that straight bars of square ready-hardened high-speed steel can be used, being ground only on the front end. The cutting edges are well supported, and the tools cheap and of such size that they readily conduct the heat away from the cut. It is, therefore, possible to work dry.

There is nothing very unusual about the boring operation except that it is split betwen two machines. The roughing is done on a 25-in. "Gisholt" big bore turret lathe, and the finishing on a double spindle Jones & Lamson machine, Fig. 5. The shells at this point are ready for the furnace room.

Coal Fired Furnace

The heat treatment is a particular feature of shrapnel manufacture, and the principles involved have been frequently discussed. As mentioned above, the equipment used is the same practically without alteration as that used for heat-treating and case-hardening

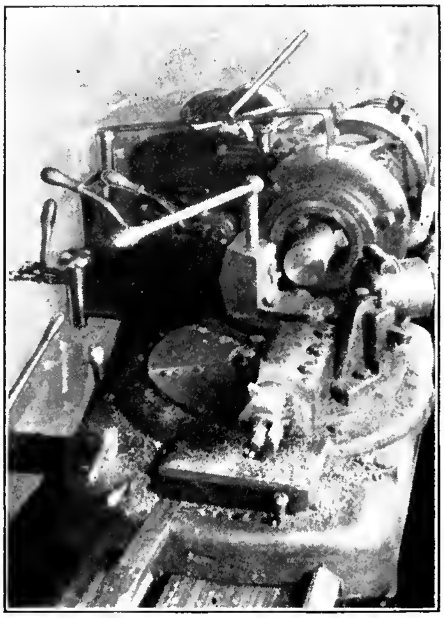


FIG. 4. UNDERCUTTING BAND GROOVE ON J. AND L. FLAT TURRET LATHE.

gears. In heating the shells for hardening, a large Brown & Sharpe oven furnace is used, and the fact that anthracite is the fuel renders this operation worthy of note. This is especially so in view of there being no sealing from the exposure to the direct heat of the fire. There are reasons for this.

First, the heavy bed of incandescent fuel, with only a moderate blast, maintains a reducing atmosphere in the furnace. Second, the base and band groove of the shell are painted before insertion in the furnace with a mixture of boracic acid and animal charcoal (bone black), mixed to a creamy consistency with quenching oil. Any slight amount of oxygen in the furnace would, therefore, have to consume the carbon before attacking the steel, and the boracic acid makes the cleaning of the surface with a rotary wire brush quite easy. No sand blast is used.

The shells are quenched at a suitable temperature in a tank of soluble quenching oil, a copious stream of oil being introduced inside the shell at the same time. Subsequent tempering to a suitable scleroscope reading brings the strength of the shell to the desired degree. The only subsequent cleaning required consists in washing in boiling soda water, rinsing off in clean water, and brushing with an "Economy" wire brush on buffing stand.

In the next operation, the nose of the shell is heated in a lead pot (gas fired) for about two inches, and crimped to shape in a hydraulic press. The shell is then reheated in the same furnace to relieve strains in the steel and afterwards placed muzzle downwards in a tray of ground mica to anneal.

The succeeding operation is done on two single spindle flat turret lathes, Fig. 6. This operation consists in trimming the shell to exact length, boring the nose, forming the inside curve, tapping the nose with a "Geometric" collapsible tap, and rough forming the outside curve of the nose. Both inside and outside curves are formed with flat cutters, brought into operation by cross traversing the head of the machine. All the operations on flat turret lathes are controlled by stops, both for length and diameter movements.

Noiseless Grinding

Finishing of the parallel portion of the body on a "Ford-Smith" grinder constitutes the next operation. The nose profile is not ground. The holding arrangement used on this machine is somewhat different from that in other shops, in that the shell is mounted on centres, using a cup over the base, and is driven by gripping the nose end on the rough shell about where the shoulder is to be finished. (See Fig. 7.) This method of driving relieves the chuck of all strain due to the pressure of the grinding wheel. The live centre offers a much firmer support for the shell, and conveys

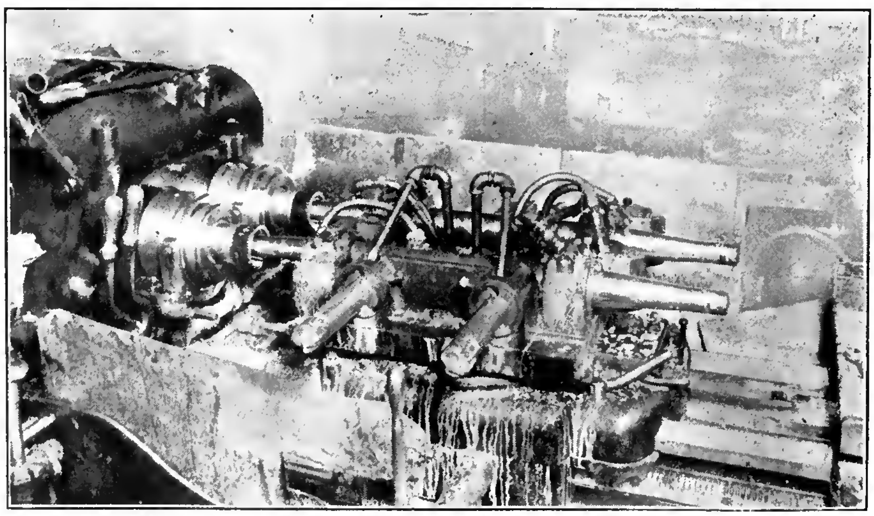


FIG. 5. BORING EQUIPMENT ON DOUBLE SPINDLE J. AND L. FLAT TURRET LATHE.

the grinding vibration directly into the frame of the machine, where it is absorbed. The reduction of noise due to this arrangement is remarkable, the shrill whistle, which is so objectionable when using a chuck, being almost eliminated.

The shells are then passed on, with the plug centres still screwed into the muzzle end, to the engine lathes (two in number), which finish the balance of the profile.

The profiling attachment used varies somewhat from the usual arrangement. The templet, Fig. 8, is mounted on a rigid bar, which is securely fastened to the tailstock instead of the headstock, as in some cases, or the lathe bed in others. The adoption of this principle overcomes the necessity for locating the shell accurately in the chuck in relation to the templet, and also enables full advantage to be taken of the allowable variation in the overall length of the shell, so that when a shell comes through which is a little long, it is not necessary to remove any more metal than is necessary to come below the high limit; whereas when the profile copy is fixed rigidly to headstock or lathe bed, the tool will cut to the same point every time, unless the shell be adjusted in the chuck, which takes time, and is not so easily controlled as the method described.

Unusual Profile Attachment

In the present case the shell is chucked without any unusual care, and the tailstock centre brought up to position. This is done by sliding the tailstock a trifle nearer the shell than necessary. The shell, previously trimmed to size on the end, and being now fitted with a centre plug, the machined surface on the end of the shell is used as a point from which to gauge the position of the tailstock, a suitably prepared point on the end of the tailstock casting being used. As the profile copy is rigidly fastened to the tailstock casting, its position in relation to the nose of the shell is determined accurately and individually for each shell.

After a thorough cleaning, the shells are carefully gone over by a shop inspector and submitted to the Government inspectors for the preliminary inspection of the completed steel shell case. On leaving the Government inspection room, the shells travel in a circular path from one machine or bench position to another around three sides of the loading room without any halt or backward motions. By this means a great saving is effected in the handling and in storage space. The first operation in the loading room is the pressing on of the copper driving bands, which is performed in the conventional manner, using a six-cylinder hydraulic press of the tire-setting type. From this machine the bands pass to a 3-in. x 36-in. Jones & Lamson flat turret lathe, where the bands are turned. Two forming tools, a roughing and finishing, are used, the former feeding radially and the latter being drawn through under the work in a direction tangent to the surface.

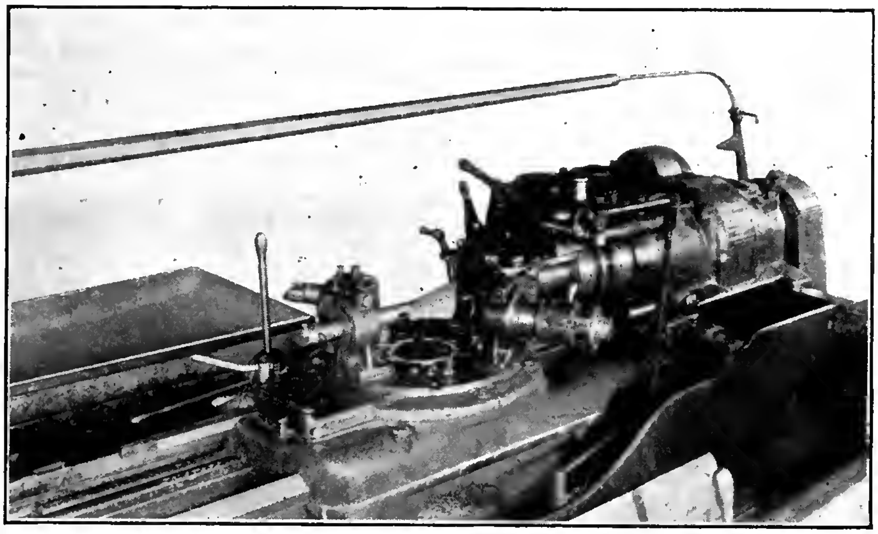


FIG. 6. MACHINING AND THREADING NOSE OF 18-PR. SHRAPNEL SHELL.

Assembling

The copper band inspector picks up the work from the tray on the rear of the lathe and, after examining the band, lays the shell on the assembling bench close by the man who puts in the tin powder cup and brass firing tube. This cuts out two handlings. The shell is then filled with lead bullets and the total weight checked. The remaining space is then filled with melted rosin, which, on cooling, acts as a matrix and prevents any loosening of the internal parts under the shock of being fired from the gun. An additional object of the rosin is to generate a cloud of smoke when the shell is exploded so that the accuracy of aim and range may be observed and controlled by noting the smoke clouds.

The weight of the shell, including the rosin, is again accurately checked, and the brass socket is screwed home in the threaded nose. The end of the firing tube projects through the central hole in the socket and the joint between these two is now securely soldered. An electric soldering bolt with hollow point is used for this operation. The shell is now ready for the last machine operation.

A Simple Lathe

The outside form of the socket is turned and the excess solder removed from the inside in a special lathe built by the Hamilton Gear and Machine Co. for the purpose. It is purely a single operation machine, being a lathe reduced to its lowest terms. It consists of a heavy spindle mounted in two generous

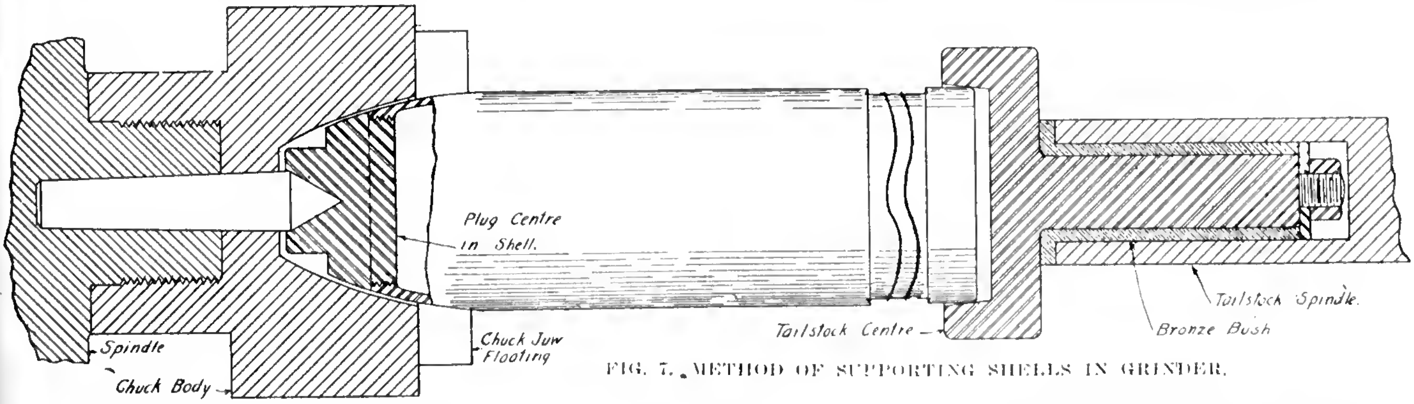


FIG. 7. METHOD OF SUPPORTING SHELLS IN GRINDER.

ring-oiling bearings and driven by tight and loose pulleys and a wide belt. The shell is mounted in a simple chuck of the hinged type, which grasps it back of the shoulder. Fig. 9 shows a plan of the tool carriage in which three tools are used—front forming tool for the curve of the profile, back forming tool for the recess or check, and a boring or facing tool for trimming the inside of the socket and removing the excess solder. The hand wheel on the cross-feed screw is large, being about 9 in. diameter, and graduated on the rim to read in thousandths of an inch. Easy reading and rapid work are facilitated by the large circle and wide graduations. Of course, simplicity of the tooling is also a factor in the quick production which is obtained with this equipment.

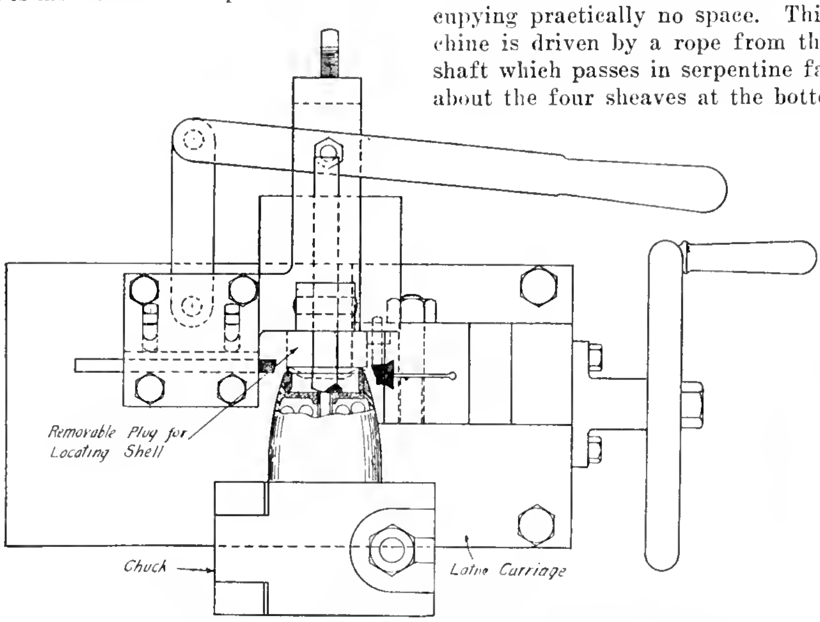


FIG. 9. PLAN OF TOOL CARRIAGE ON SOCKET TURNING LATHE.

Flat Die Marking Machine

The sockets are next hand-tapped with an expanding adjustable tap, which is kept in accurate agreement with the Government gauges, then passed to an inspector and afterwards to the marking machine. The latter handles the shell in the usual oscillating manner, supporting it on rollers, but differs from the usual type, in having the letters in a flat die holder, which is traversed back and forward under pressure by a rack and gear segment. This form of construction has a number of advantages, chief of which is the cheapness of type and the readiness with which they can be changed when single letters become damaged or worn out.

After marking, the shells are carefully blown out with compressed air and again checked for weight before passing to the Government inspector for the final inspection and marking with the official acceptance stamp.

The last operation is the painting, which is done on a four-spindle machine let into a slot in the bench top and occupying practically no space. This machine is driven by a rope from the line shaft which passes in serpentine fashion about the four sheaves at the bottom of the spindles. After painting, plugs are screwed into the sockets to protect them from damage in shipping, and the shells are packed in the regular six-round boxes supplied by the Government.

The main feature of this plant, aside from some very ingenious examples of tooling, is the demonstration of how much can be done with very limited floor space in the way of eliminating storage intervals and handling between operations. The machines are set very close, and at each operation where possible the shifting from one machine to another is done by an inspector, who picks up the work from the previous machine and, after examination, places it ready for the next operator. In many cases he can do this without taking more than one step. On some operations, galvanized iron chutes are used to carry the shells between inspectors' and operators' positions.

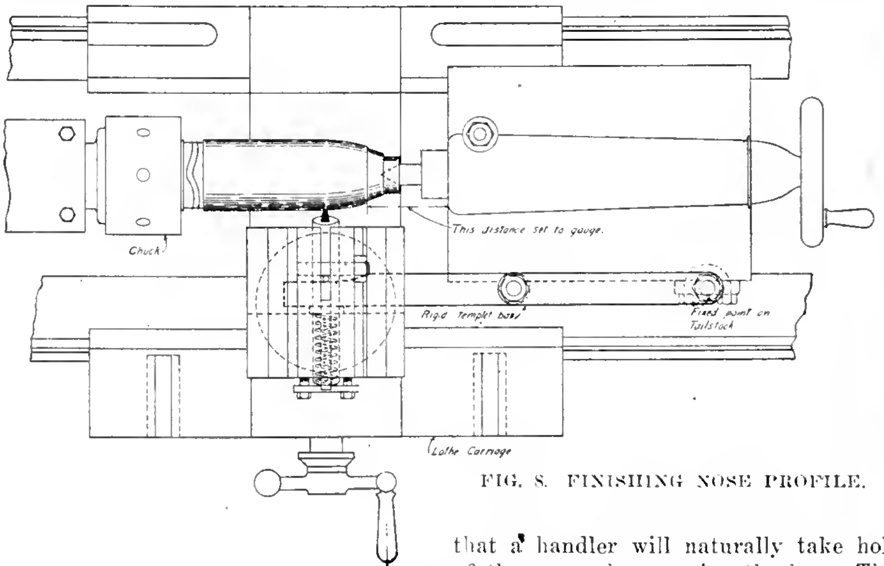
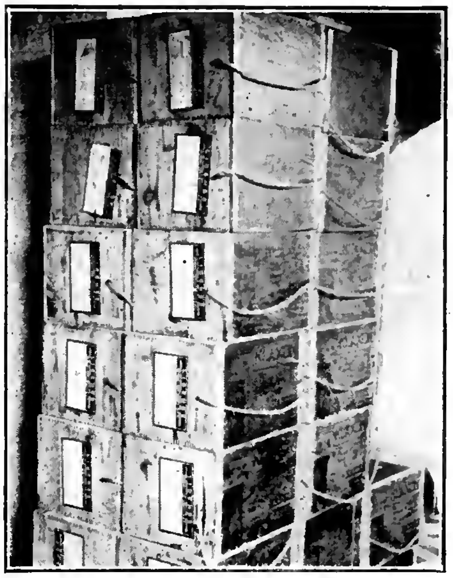


FIG. 8. FINISHING NOSE PROFILE.

A SHIPPING KINK.

By A. E. G.

THE Lovell-McConnell Mfg. Co., Newark, N. J., makers of Klaxon automobile signal horns, had considerable difficulty in packing the latter so that the bell of the horn would not be dented in transit. The trouble was principally caused by the handlers dropping the box in which the horn was packed with more or less force, and if the bell of the horn happened to be



A SHIPPING KINK.

downward, the result was almost sure to be a dented or crushed bell.

Someone in the shipping department finally hit on the plan of putting rope handles on all the shipping boxes, so that a handler will naturally take hold of the rope when moving the box. This keeps the boxes top up in almost every instance, and as the horns are packed accordingly, the result has been very satisfactory.

PRODUCTION METHODS AND DEVICES

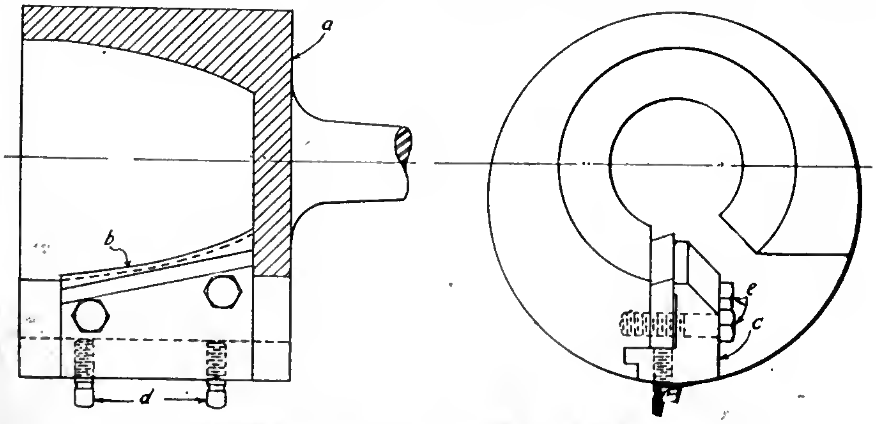
A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

HOLLOW PROFILE MILL FOR SHELL NOSES.

A SIMPLE design of hollow mill with single inserted cutter for finishing the nose profile of 3.3-inch H.E. shells is shown in Fig. 1. The cast iron body (a) is provided with a suitable taper shank to fit drill spindle, and is bored out, as shown, to fit the finished shape of the shell. This hole is concentric with the shank, but the outside diameter of the mill is made considerably eccentric. In the end view it will be observed that this heavy side is partly cut away to allow of the blade (b) being secured in the proper position. Clamping plate (c) is formed with a heel which fits into check shown, and provides suitable support for the adjusting screws (d) which are used in setting the blade (b).

Clamping screws (e) pass through clearance holes in the plate, and into tapped holes in the body (a). Blade (b) has two oval holes with ample clearance, so as to allow of considerable wear on the cutter being taken up without fouling screws (e).

Suitable clearance space for chips, etc., is provided by this design. This tool is used only for the finishing cut or scrape, and enables the desired profile to be obtained easily by means of adjusting screws (d).



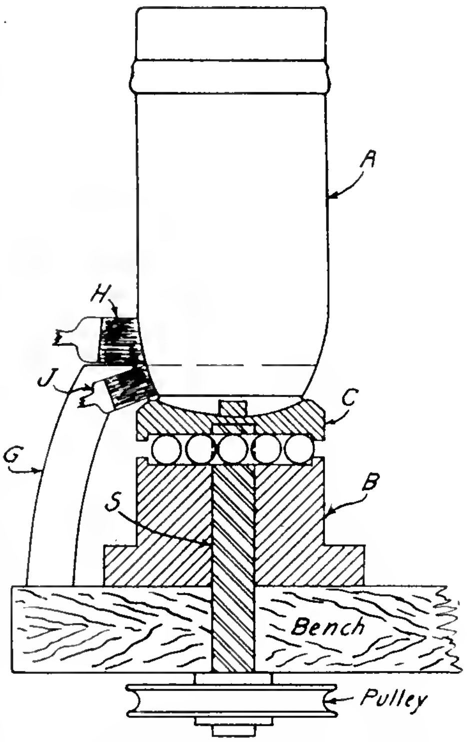
FINISHING CUTTER FOR SHELL NOSE.

BALL-BEARING SHELL PAINTING DEVICE

By J. H. R.

SHELL manufacturers throughout the Dominion are employing several different methods for painting shells. The device here shown is used in one of our smaller plants, and while the output is somewhat less than with other painting machines, it meets the requirements of the shop production.

The cast iron base B which is secured to the bench, has a ball-race of suitable size machined on the top. Through the centre of base B a hole is drilled to fit



BALL-BEARING PAINTING DEVICE.

the shaft S, the latter being fastened into the head C which is also made of cast iron. A ball-race of the same dimensions as that in the base is machined on the bottom of C and on the top is formed a cup-shaped recess with a square pin projecting upwards to engage the square hole of the plug in the shell nose. Several balls of a suitable standard size are placed in the ball-race, and the head C is placed in the position as shown in the drawing. The operation is as follows:

The shell is placed in the head C, the latter being revolved slowly by means of a small grooved pulley placed on the shaft S, beneath the bench. In painting, the brush H is held against the revolving shell and is moved along the body as far as the limit set by the gauge G. This gauge is of the correct height and is fastened to the bench. Above this gauge the shell is painted dull grey and below by means of the smaller brush, J, the nose of the shell is colored red also to the required distance.

SUGGESTION FOR CUTTING SPIRALS.

By G. Miller.

THE following rule or idea may not be new; in fact, may be known to a large number of mechanics, for, as a certain wise man once said, "there is nothing new under the sun," yet as the writer has never seen it mentioned in any mechanical paper, and as it may be of assistance to some worried mechanic and help him out of a "hole" some time, its uses and advantages are here set forth.

The printed tables accompanying universal milling machines do not give all possible combinations of gears for cutting spirals, and to "figure out" the right gears to cut a special spiral for which the printed table does not make provision, requires, in some cases, a considerable amount of mathematical knowledge. Suppose we wish to cut a groove in a one inch piece—a one inch twist drill blank for example,—so that this groove makes one complete turn around the piece in a length of six inches. If we were able to unroll this piece into a flat surface, we would have a rectangular piece of 6in. long by 3. 1416 in. wide with a groove diagonally across its face from one corner to the other as shown by Fig. 1, or if we wish to cut a spiral 1 in. in diameter, the groove to have one complete turn in 3 in., its unrolled surface would be represented by a rectangle 3 in. by 3. 1416 in. with a groove diagonally across its face from corner to corner as shown by Fig. 2.

From this it can be easily seen that to cut any spiral it is only necessary to know the diameter of the piece and the lead of the spiral, that is the length of piece required for the groove to make one complete circle around it. From these dimensions a rectangle can be easily drawn. The difference in the length of the base line and the upright line is the ratio between the turning gears and the feeding gears. If the

piece to be cut has a circumference of 4 in. and the groove is to make one complete turn in 2 in. this would be represented by an angle with a base line of 4 in. and an upright line of 2 in., which would show that the revolution of the piece to be machined would be double the speed of the feed of the machine, the base line in all cases representing the revolution of the blank and the upright line representing the feed.

The writer is reminded in this connection of a certain case where some thousands of spirals were to be cut in a cer-

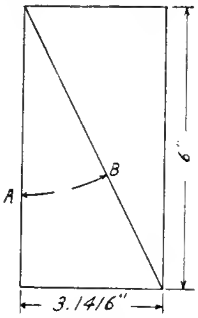


FIG. 1.

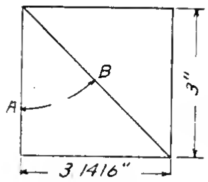


FIG. 2.

tain shop on one of the best makes of American milling machines. In this particular instance the printed rules accompanying the milling machine had to be cast aside as utterly useless and the rule herein given was successfully applied. There is another application of this rule that the writer has found useful.

It may not be generally known that the printed tables accompanying universal milling machines do not always and in all cases give the correct number of degrees and minutes to set over the table when cutting spirals. This statement will probably be discredited by some people, especially makers of milling machines, but the writer knows it to be true, not only by years of observation, but by actual experience.

All mechanics when cutting spirals know that if the "set over" of the table of a milling machine is not parallel with the proposed groove in the blank, the cutter will "drag" more or less on one side or the other, and raise a burr that is detrimental to good work. The writer has seen burrs raised on spirals by a too faithful adherence to the printed tables that would set one's teeth on edge, mechanically speaking. By use of the rule given in the first part of this article and a very slight knowledge of trigonometry, the correct position for the milling machine table can be quickly found. All that is necessary being to know what angle it is from A to B, Fig. 1 or 2, the unrolled diagram of the proposed spiral being the correct angle to set over the table. By making a very careful diagram of the angle and using a good bevel protractor a very close approximation to correct measurements can be found. It may be objected that it is not necessary to go to all this trouble as the correct angle for the table may be found by marking across the blank with the milling cutter and then using a straight edge, but this method can be used only with spirals of very little lead, and only in some cases, and can never be used with any assurance of success when cutting spiral gears with larger lead.

OIL-GROOVING ON A PLANER

By A. E. Granville.

MANY firms building machine tools still chisel out the oil grooves in their machine beds and tables by hand, using a round-nosed gouging chisel. This is a slow process and, as a rule, looks amateurish, except on machines that are too large to have the work done in any other way. The oil-grooving of gibs or other small pieces by hand, however, has little excuse where the parts are used in any reasonable quantity, as there are numerous ways of doing the work quickly and cheaply on a planer.

A planer rigged up for grooving gibs is shown in Fig. 1. Here the gib is placed in a holder, which is bolted to the planer table. The gib is butted against one end of the holder, and is held in place by two set screws and clamping pieces A and B. The oil groove cut is plainly shown at C. In placing the attachment on the planer, the cross-fed screw is loosened so that the saddle will move freely on the cross-rail. The bracket D is then clamped to the rail as shown. This bracket carries the bell-

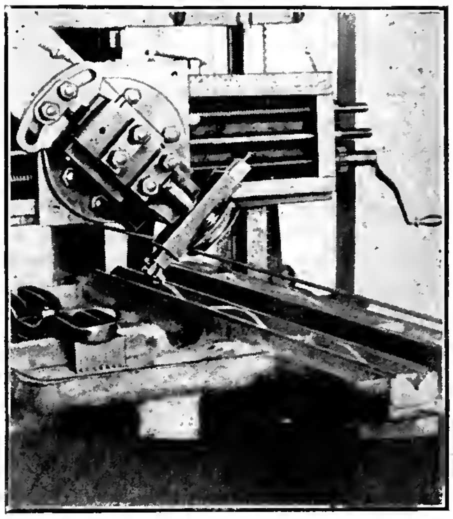


FIG. 3. HEAD SET FOR BEVEL WORK.

crank E, which is connected to the saddle by the link F, while a connecting rod G connects the other arm of the bell-crank to the crank disc H.

A ball-and-socket joint is used at each end of the rod G in order to allow for the movement as the mechanism operates. The crank-disc is geared to the main driving shaft, so that the saddle is given a rather slow reciprocating movement, as the planer table travels beneath it. The amount of stroke can be varied considerably by adjusting the end of the rod G in the slot of the crank-disc, and also by sliding the bell-crank up or down in the slot of the bracket. The gearing may also be changed when needed. When

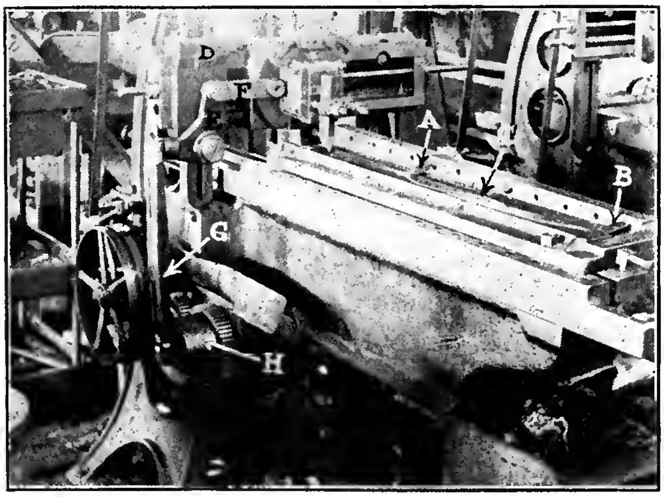


FIG. 1. ATTACHMENT FOR GROOVING GIBS.

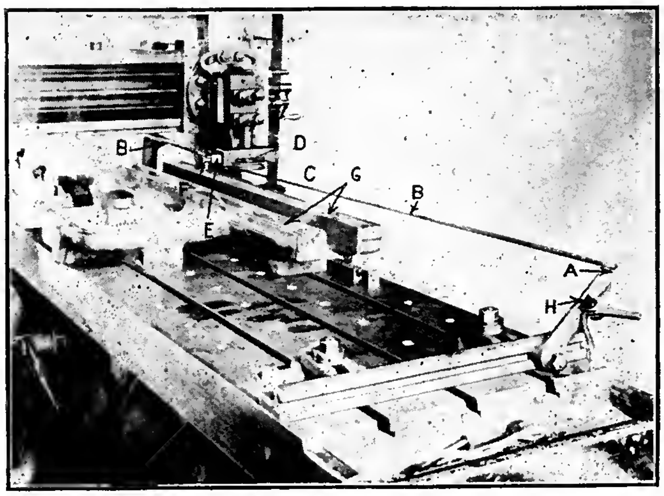


FIG. 2. ATTACHMENT FOR GROOVING FLATS OR BEVELS.

not in use, the whole apparatus may be detached and the planer employed as usual.

Another somewhat simpler device is shown in Fig. 2. An arm A is fastened to the planer table, as shown. A piece of window cord is run from this arm, wrapped once around the grooved pulley C, and then fastened to another arm at the back. The hub of the grooved pulley is turned eccentric at D, so that as it turns the slide E, carrying the tool F, is given a reciprocating motion. Now it will be plain to the reader that as the planer table travels back and forth the cord will cause the pulley to revolve, and when properly set, the tool will cut oil grooves, as shown at G. This device has the merit, that while not as workman-like as the first described, it is easily made, and can be placed on any planer without altering the mechanism in any way.

When grooving V's the head is tilted, as shown in Fig. 3, but otherwise the parts are left as for flat work. This is an advantage not possessed by the other device.

FUSIBLE PLUGS FOR BOILERS.

AN investigation of fusible tin boiler plugs, just completed for the Bureau of Standards by Dr. G. K. Burgess and P. D. Merica, will probably result, says the Iron Age, in the substitution of a new series of specifications for those heretofore employed by the Steamboat Inspection Service, the American Society of Mechanical Engineers and the Interstate Commerce Commission. The results of the investigation indicate that through the lack of technical knowledge on the part of manufacturers and users of the behavior of tin plugs containing relatively small percentages of impurities this safety device has been rendered practically valueless in the average boiler. By the use of simple precautions suggested by the Bureau's experts, it will be entirely practicable to produce plugs that may be relied upon to fulfill their functions under all conditions.

Fusible Plugs and Their Function.

The fusible boiler plug in its usual form consists of a brass or bronze casing with external pipe thread, filled from end to end with a fusible metal or metal composition which has a melting point around 480 deg. F. These plugs are fitted at various places into the boiler, in the flues, tubes or combustion chamber, in such a position that they are about 1 in. or more above the dangerous low water level, with one end on the fire and one end on the water side. As long as the water level in the boiler is above these plugs, the temperature of the latter remains below the melting point of the filling, but if the water falls much below the level of the plug, opportunity is given for local overheating and the filling of the plug then melts and is blown out.

Tin of Plug Changed to Tin Oxide.

Tin seems to be the metal used at present almost exclusively as the fusible constituent of such plugs and is required by all standard specifications. It would seem to be in this respect a desirable metal, having a low melting point, being only slightly corrodible and easily obtained pure. Its desirability in this respect is nevertheless to some extent called in question by the results of the investigation which has just been completed by the Bureau of Standards. This inquiry was undertaken to determine why certain plugs have been found intact in boilers which have exploded as the result of low water and consequent overheating of the boiler plates.

Heavy loss of life occurred as a result of one of these explosions. The plug in this case was sawed open longitudinally and was found to contain traces only of the original tin, imbedded in a dirty, greenish matrix, which was ascertained to be largely tin oxide, and which upon test showed a melting point about 2,900 deg. F. This oxide was distributed in such a form and quantity that it held the pressure of the boiler and would not have melted until the bronze of the casing and even the steel of the boiler had melted. It is obvious from this examination that when reliance is placed upon such a plug to give warning of dangerous boiler conditions it is looked upon as an actual source of danger instead of safety.

Plugs of Faulty Manufacture.

The question thereupon arose as to the source of the tin oxide, as to whether it was there originally, or had been formed by corrosion, and if so, is the cause for its comparatively rare occurrence in such plugs to be sought wholly in the different operating conditions of the boilers, or is it a fault in the method of manufacture?

A request was made of the Steamboat Inspection Service that more plugs be sent in to the Bureau for test, including both new plugs and those which had been removed by inspectors. About 1,050 plugs were subsequently received, of which about a hundred had been in service varying from 4 to 12 months. The entire collection represented the products of 105 firms of manufacturers. After these plugs were tested for dimensions, they were sawed open axially through the centre, and the form and condition of filling observed. Particular attention was paid to the presence of oxide, scoriae, blow holes and other faults originating either in the manufacture of the plugs or during their service.

The Bureau's investigation demonstrated that the correct design of a fusible plug is of more importance than might be supposed. Owing to the difference in the coefficients of expansion of the casing and of the filling of such a plug and to the existence of an allotropic change in tin at 320 deg. F., there will be interplay between casing and filling unless the design is such as to support the filling rigidly in the casing and the adhesion between the two is excellent. A smooth bore "tapering evenly from end to end" is, therefore, not to be recommended, and it is noted that the Steamboat Inspection Service has recently allowed a fine inside thread. In the opinion of the Bureau's experts, however, there is no reason why a thread should be allowed and not other types of recess or projecting shoulder to keep the tin filling rigidly in place.

As a result of the examination of the sample plugs and an investigation of the reported failures and of certain tests made at the Bureau, it appears that the failures of tin plugs are of two types; first, those in which the oxide forms as an interlocking "network" throughout the tin of the filling and, second, those in which the oxide forms as a solid, hard mass at the fire end of the plug. An explanation of the formation of the network was found in the presence of zinc in amounts varying from 0.3 to 4.0 per cent. The experts also reached the conclusion that plugs containing zinc in quantities mentioned were apparently in good condition when inserted, but subsequently underwent a progressive change, becoming no longer fusible in the sense that they would melt below a temperature sufficient to fuse the steel plates of the boiler.

Zinc Should Not be Used With the Tin.

"The fact that stands out most strongly throughout this investigation," says the report in conclusion, "is that zinc should not be present in the tin fillings of fusible plugs. The lowest zinc content actually found in any of the plugs analyzed, which displayed the network type of oxidation, was 0.3 per cent., but this cannot be accepted as the actual lowest value of the zinc content at which oxidation can take place. Furthermore, although zinc is, because of its greater corrodibility, most dangerous when coalesced into a network of structure such as is developed upon heating to about 180 deg. C., other metals which do not form solid solution with tin may also cause the formation of this structure, as, for instance, lead.

It seems then that in such plugs tin must be used which is as free as possible from zinc and lead. This statement is made notwithstanding the apparent fact that if zinc is present a small content of lead is actually beneficial. It is better to prevent this oxidation by using pure tin than by using lead with tin containing zinc."

Principles of Laying-Off Cylindrical Intersections--V.

By J. W. Ross

The more or less special nature of the work involved in the making of sheet metal piping has caused many manufacturers to avoid this class of work, with the result that when a job has to be handled, there is frequently considerable unnecessary loss incurred through errors in laying off material. The examples treated by the writer of this article should form a valuable reference to many manufacturers on ordinary as well as special occasions.

RECTANGLE INTERSECTING A CYLINDER.

THE same principles are adopted in this or similar problems as was adopted in the preceding problems of intersections. Fig. 38 shows the perspective, Figs. 39 and 40 the elevation views. Enough information can be obtained from the drawings without any explanation. Develop the patterns, Figs. 41 and 42, in precisely

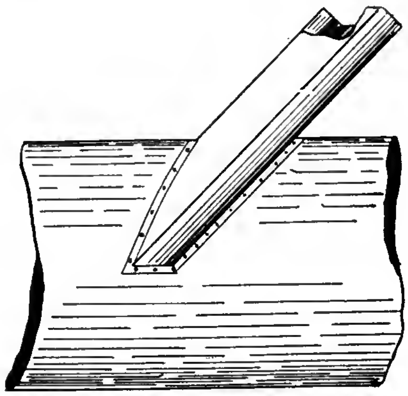


FIG. 38.

the same manner as the problem shown in Figs. 34 and 35.

Connecting Pipe Between Two Circular Tanks.

The perspective view, Fig. 43, and the elevation, Figs. 44 and 45, show a connecting pipe between two circular tanks. This problem deals with heavy plate. The patterns are developed in accordance with the instructions given on heavy plate in development of the problem shown by the Figs. 18 and 19.

Y or Three-way Pipe.

The intersection of three pipes forming a Y is shown in the perspective drawing, Fig. 49, and the elevation view, Fig. 50.

Construction.

Draw the horizontal line, 7° 1°, Fig. 50, equal to 1 inch. Bisect at 4° and erect the perpendicular 4° 7^1. Locate the point 4^x, $\frac{7}{8}$ in. from 4°. At an angle of 45 degrees to the horizontal line draw the inclined line 4^x 10. Also line 4^x 4, each equal to $1\frac{5}{8}$ inches. At right angles draw the line 7 4 1 equal to 7° 4° 1°. Draw the line 7 7^1 parallel to 4^x 10—to the intersection of the vertical

*Note: The reference letters and numerals in the text, i.e., G^2, 7^2, etc., correspond with those of the illustrations indicated as G'', 7'', etc.

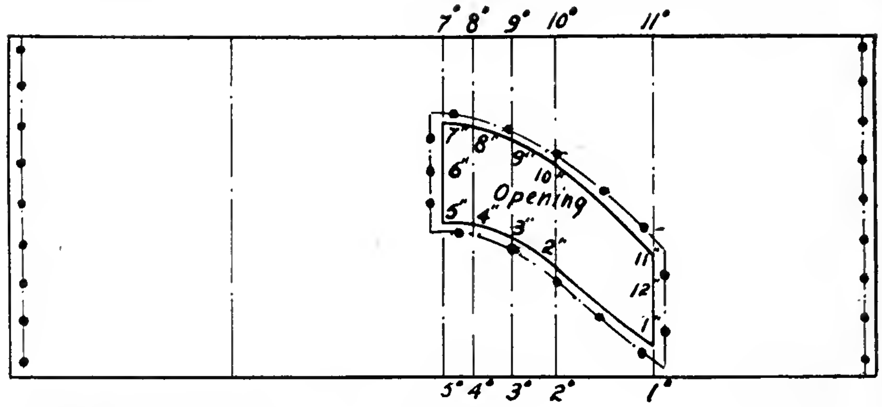


FIG. 42.

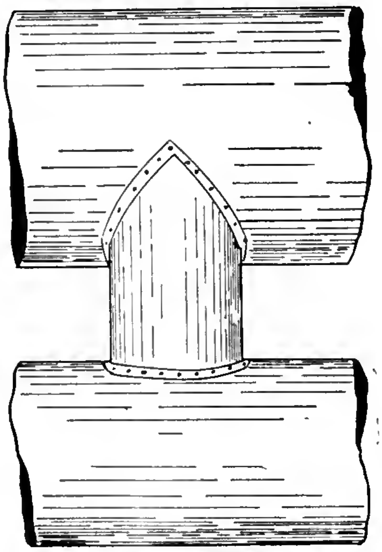


FIG. 43.

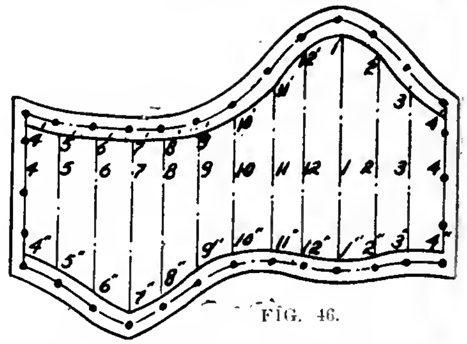


FIG. 46.

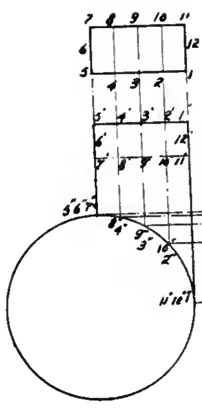


FIG. 39.

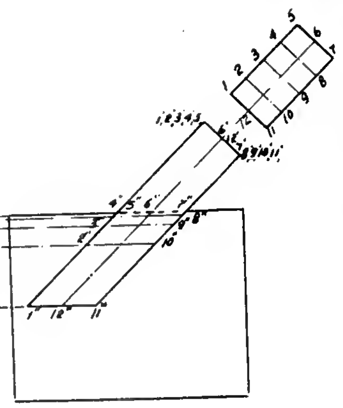


FIG. 40.

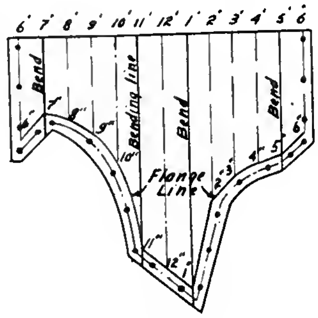


FIG. 41.

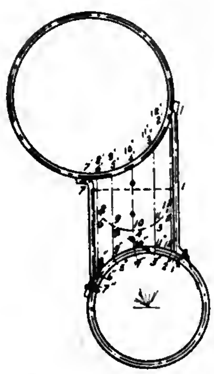


FIG. 44.

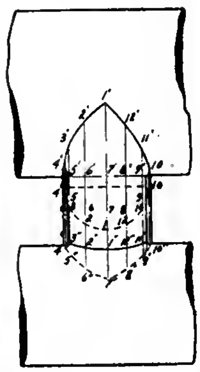


FIG. 45.

line 4° 7'. Also parallel to 4^x 10 draw the line 1 1^x to the intersection of the vertical line 1° 1^x. Connect 4^x to 1^x. Construct the left-hand side of Fig. 50 in a similar manner. Then 7^2 4^x 1^x defines the

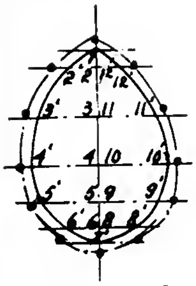


FIG. 47.

FIG. 48.

mitre line for the lower course, and 1^x 4^x 7^1 for the inclined course. With O as centre describe the plan view, 1 4 7 10. Divide into 12 equal spaces. Project these points to the mitre line, 7^2 4^x 1^x. Again, with X as centre describe the plan view of the inclined pipe as shown by the circle 1 4 7 10. Divide into 12 equal spaces. Project these points —parallel to 10 4^x—to the mitre line

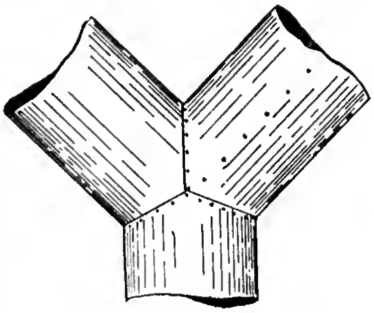


FIG. 49.

7^1 4^x 1^x. Draw the stretchout 1° 1°, Fig. 52. Divide into 12 equal spaces. Transfer the measurements 1° 1^x, 2° 2^x, 3° 3^x, etc., Fig. 50, to their similar lines in Fig. 52. Draw a curve to define the mitre or flange line; add the laps. Space in the rivet holes. Similarly transfer all the

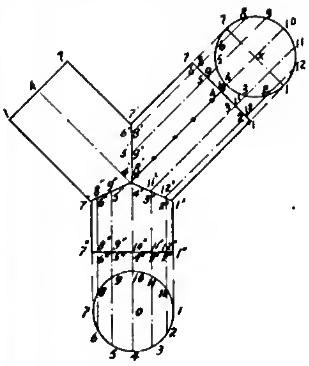


FIG. 50.

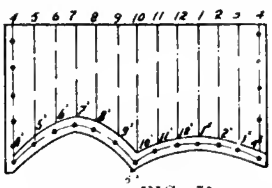


FIG. 51.

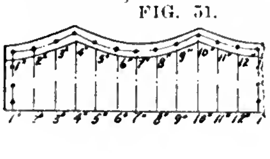


FIG. 52.

element lengths of the inclined cylinder to their respective points on the calculated stretchout, Fig. 51. Fig. 51 will be the templet for both the inclined cylinders. The preceding problems cover fairly well the various intersections developed by parallel lines. In the next article conic intersections will be dealt with, showing the radial method.

GRINDING AS A MANUFACTURING PROCESS.

By Howard W. Dunbar.

GRINDING for manufacturing operations, as distinguished from grinding simply for accuracy, such as tool room grinding, requires that the work in hand be given intelligent thought by the manufacturer. The grinding machine, alone, without the aid or intelligence of the engineer, superintendent and manager, can never be successful.

It is not the intention of the grinding machine manufacturer of to-day to depreciate the value of the lathe, milling machine, planer or any of the other more commonly known forms of machine tools, but rather, owing to the presence of the modern grinding machine, the value of these other forms of machine tools is enhanced; the only change in the conditions to-day being that the modern grinding machine calls for a greater effort on the part of the makers of lathes, milling machines, planers, etc., to make good, heavy, well-built machines with which to assist the grinding machine in the production of work more quickly and economically. A great many of the differences of opinion are purely psychological, and because tradition has said, do so and so.

Importance of Turning.

In the manufacture and use of the grinding machine the question of turning is of the greatest importance, and in turning is the greatest of all savings, when we have the modern grinding machine to grind accurately to size and with good finish. Here is made possible the cheapening of the turning operation, but to do this we must have good, heavy lathes, capable of performing the work in the manner best suited for the grinding machine operations. As a rule, most machine tool users do not consider this.

The proper relation of turning to grinding (and by this is meant the way and manner in which the operation is performed, the amount of stock removed by the lathe, the amount of stock removed in the grinding machine, the number and depth of the cuts, etc.) can only be determined after scientific investigation of each piece to be finished. No rule can be laid down whereby it becomes an established fact. Sometimes it is most profitable to grind without turning at all; more times it is not. The statement of this fact generally starts every one to grinding from the rough, whereas each piece should be studied, and the proper operations applied, if you wish to determine the cheapest way of producing your parts.

Economical Production of Cylindrical Work.

This brings us to one of the points for consideration—the most economical method of producing cylindrical work. To start with, let us make a radical departure from the now common form of organization in most all machine shops. It is our firm belief that the turning department and the grinding department should come under the same foremanship, as the finished part requiring grinding is only produced at least cost when the proper relationship of the turning operation to the grinding operation has been determined. So, by placing the responsibility of the final cost with one man we are working towards the end which must result in the most economical production of round work.

The grinding machine to be successful requires that all tradition be thrown to the winds. To illustrate: Tradition tells a lathe operator that he will save time in turning by taking one cut, and that a deep one, if his lathe is powerful enough. Investigation of the proper use of the grinding machine shows that in many cases the work can be produced for less cost if two or even three cuts are taken in the lathe, for the reason that sometimes the work is too frail to stand the rapid traverse feed with one deep cut. In such cases two cuts, even three, will sometimes prepare the piece properly for the grinding machine in less time than the single cut with slower traverse feed.

Again—tradition tells the lathe operator that if he turns his work very close to size it will require less time for grinding. This is true, but it may not be true that the work will cost less thereby.

In the case of long, frail work like countershafts, etc., tradition tells us they must first be turned and then ground, and it is true that in producing such a piece, 1-16 in. in diameter can be removed in less time in the lathe than it can be done in the grinding machine, but it is not true in all cases that it will cost less, for the reason that when such pieces are turned rapidly with one single cut in the lathe, although only 1-16 in. is removed, they must be straightened before they can be ground.

We have in mind a piece of work that required six minutes for turning the roughing cut and nine minutes for grinding the roughing cut, but the straightening of this work after turning required nine minutes. So in this

case the turning was literally thrown away. These pieces were afterwards rough ground, taking off the 1-16 in. in nine minutes, requiring no straightening after the rough grinding operation and the workman then had simply to finish grind in the usual manner.

It must not be understood that we recommend grinding without turning in all cases; we do not. The reverse is usually true, but it is also true that thousands of dollars are thrown away every year because shops follow tradition and turn everything before grinding and thousands more are lost because shops following tradition, turn work too nicely and too expensively and too close to size.—Grits and Grinds.

COAL-TAR PRODUCTS USED IN MAKING EXPLOSIVES

By C. G. Storm.

MONONITROBENZENE, commonly known as "oil of mirbane," is little used in the explosives industry because of its volatility, although it is sometimes used as a minor constituent of certain low-freezing dynamites and other types of explosives. It is used much more extensively in soaps, lubricating greases, etc., mainly for the purpose of imparting a more or less agreeable odour. Furthermore, it forms an intermediate product in the preparation of aniline and its many derivatives.

Among the aniline derivatives of importance are tetranitroaniline and tetranitromethylaniline, both of which have in the past few years assumed prominence as detonating explosives for projectiles, mines, and torpedoes. Many other derivatives of aniline have been found to be applicable as stabilizers or as gelatinizing agents in nitrocellulose smokeless powders. Among such substances are methyl or ethyl phenyl urea, phenyl benzyl ether, phenylacetanilide, formanilide, and diphenylamine. The latter is, however, the only one which has been used in this country. The nitrotoluenes are more extensively used in the explosives industry than any other nitrosubstitution compounds, being employed chiefly for sensitizing certain types of ammonium-nitrate explosives and for lowering the freezing point of the low-freezing dynamites.

In the absence of exact statistics, a rough estimate places the amount of the various grades of nitrotoluenes used in the low-freezing dynamites manufactured in this country in 1913 at about 2,000,000 lb., while in the "permissible" explosives employed in coal mining probably 250,000 lb. of the same materials were used during the same year.

Pure crystalline trinitrotoluene has proved one of the most efficient explosives for use in explosive shells, torpedoes, and mines, and is extensively used by almost every important military service, including that of this country. In recent years it has also come into use as a substitute for a large proportion of the mercury fulminate in detonators (blasting caps) and as a charge for detonating fuse.

The nitronaphthalenes are used to some extent, chiefly as sensitizers, in the "short-flame" permissible explosives of the ammonium-nitrate type. Certain derivatives of these compounds, the alkaline salts of nitronaphthalene sulphonic acids, produce, when mixed with sodium nitrate and other ingredients, explosives suitable for coal mining.

Picric acid (trinitrophenol) and certain of the picrates are highly important as military shell explosives; the acid is also employed in surgical dressings for burns and wounds. The manufacture of these compounds depends entirely on phenol (carbolic acid) as a raw material.

The possibilities of the use of the nitroderivatives of coal-tar products in explosives are far greater than is indicated by the above brief summary. Much investigative work on such compounds is being carried on in this country as well as abroad, from which important developments in the explosives art may result. The Bureau of Mines has instituted a systematic research into the preparations and properties of these nitrosubstitution compounds with a view to studying their possibilities in the explosives industry. — From Technical Paper 89, the Department of Interior, U.S. Bureau of Mines.

GERMANS TRY TO GET SHEFFIELD STEEL

IT is reported that the Sheffield Chamber of Commerce has recently investigated some ingenious attempts to obtain high-speed steel and high-class tool steel from Sheffield manufacturers for the use of alien enemies. These special tool steels are necessary in all shops making munitions of war, and as Germany in peace time imported considerable quantities from Sheffield it is probable that she is feeling the necessity of new supplies. The attempts to place orders have been made with great circumspection and it was only the special knowledge of the president of the Sheffield Chamber that brought about the exposure in one case. The Chamber has issued a notice to manufacturers warning them that all inquiries should be carefully scrutinized "in view of attempts now being made to secure high-speed and high-class tool steels for the use of alien enemies. Manufacturers are asked to exercise the same caution even where orders are offered by London agents.

CUSTOMS RECEIPTS SATISFACTORY

CUSTOMS receipts for the month of August, according to official figures issued by the Department of Customs, Ottawa, amounted to $8,330,604.04. This total is very slightly under that of August, 1914-15, when the receipts showed the result of heavy ex-warehousing of bonded liquors in anticipation of the tariff increase. Very large quantities of imported liquors, it will be remembered, were taken out of bond in an effort to escape the heavier duties which, it was expected, would be imposed in the Finance Minister's war budget. Even with this abnormal collection of duty on liquors, the receipts for August last year exceeded those of last month by only $53,202.50.

The statement for this year is accordingly regarded by officials of the Customs Department as in every way satisfactory. The same is true of the statement for the five months of the fiscal year, as compared with ante-bellum months of last year, and making the same allowance for the ex-warehousing which took place in August. The receipts for the five months of the present fiscal year amounted to $36,731,165.01, as against $37,125,639.92 for the corresponding period of 1914-15.

LACHINE CANAL TRAFFIC.

DURING the month of August just closed, the amount of grain brought through the Lachine Canal was 4,651,079 bushels less than what came through in August, 1914. Returns made public yesterday afternoon by the canal authorities indicate a falling off in practically every line of activity connected with the waterway. Coal shipments decreased by 36,661 tons, while not a single sack of flour came down the canal last month, as compared with 102,972 recorded twelve months ago.

Tonnage Lower

There were 1,116 trips through the canal last month, fewer by 347 than last year. The tonnage operated was 589,317 as against 780,352 tons in 1914. The passengers carried through the canal and down the Rapids were 20,453, or 8,206 less than in August, 1914. This last total showed an improvement, however, over the previous month. The cargo tonnage last month was 470,930, a decrease of 190,382. The number of trips light in August, 1915, was 369, as compared with 515 in August, 1914.

For the whole season to August 31 the total grain coming through the canal has amounted to 25,008,924 bushels, just 17,222,206 bushels less than for the same period in 1914.

The propeller efficiency of aeroplanes in practice is about 60 per cent.

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Machine, Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

BAND TURNING LATHE FOR 4.5 H.E. SHELLS

THE Jenckes Machine Co., Sherbrooke, Que., have placed on the market a new band turning lathe for 4.5 high explosive shells, particulars and illustration of which are as follows:—

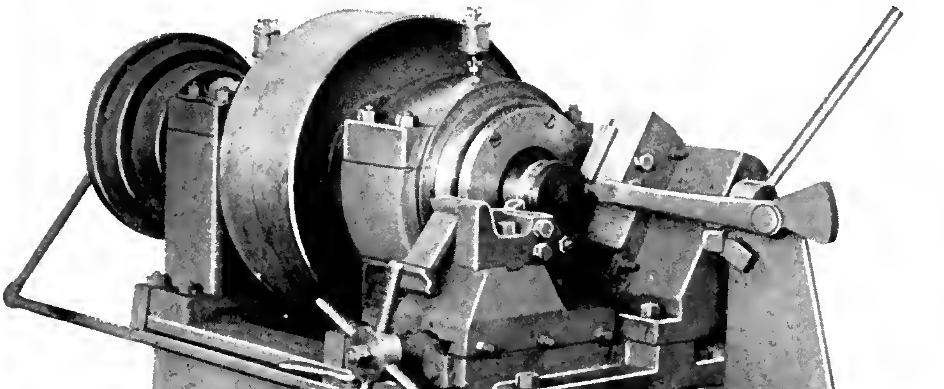
The bed is of the heavily ribbed flat top type, and is mounted on legs of standard type. In place of the regular headstock, two substantial capped bearings are used, each being secured to the bed by four suitable bolts. The bearing caps are machined, and are held by four studs. The bearing is 6 in. diameter by 7 in. long, being babbitted, bored, and finally scraped to the spindle. The spindle is a hollow steel casting, turned all over and finished by grinding. The drive is through a 22-in. by 8-in. clutch pulley mounted on the spindle and bronze bushed.

The clutch is of hard maple, cone type, and the full size of inside of pulley. It is operated by a compressed air piston controlled by a valve easily within reach of the operator's left hand. The clutch mechanism is all built into the spindle, and when in use has no tendency to move the latter endwise or cause end friction. Means are provided, however, for taking up end play of the spindle should wear occur. The chuck is operated by compressed air and is of the draw-in type. It is bolted into the large end of the steel spindle and controlled by the same valve mechanism as operates clutch.

The tool slide base is heavy and is clamped immovably to the lathe bed. The front or roughing tool is fed in by screw and hand wheel to a dead stop, and leaves a light cut for the finishing tool, while the finishing tool is mounted to the rear and above the work. The tool can be adjusted to pass down behind the shell, and in passing shave the band to size. The feed is by lever and pinion.

The tools can be removed for grinding, and be replaced with precision. They are held in steel blocks by a clamp gripping the dovetailed portion of the tool. The tools are formed of "Novo Superior" steel, $4\frac{1}{2}$ in. long. The shell is located by a swinging finger on front tool block before the chuck is tightened.

A hinged scraper rest is provided on front tool block for removing the ragged edge at each side of band after tooling. No countershaft is required, the lathe being driven direct from the main line shaft of motor. About 10 horse-power is required to operate the machine, together with a small quantity of compressed air at available pressures.



COPPER BAND TURNING LATHE FOR 4.5 HIGH EXPLOSIVE SHELLS.

A NEW "GARDNER" GRINDER

IN bringing out this new machine, the manufacturers, the Gardner Machine Co., Beloit, Wisconsin, claim to have developed a disc grinder which has immeasurably broadened the possibilities of the disc wheel; a disc grinder which will not only handle with greater speed and accuracy all the work that their earlier types do, but a great number of additional operations which heretofore had been proven unsuited to this manner of machinery. It is a complete grinding unit, each machine being equipped with dust exhauster, water system and cast iron hood.

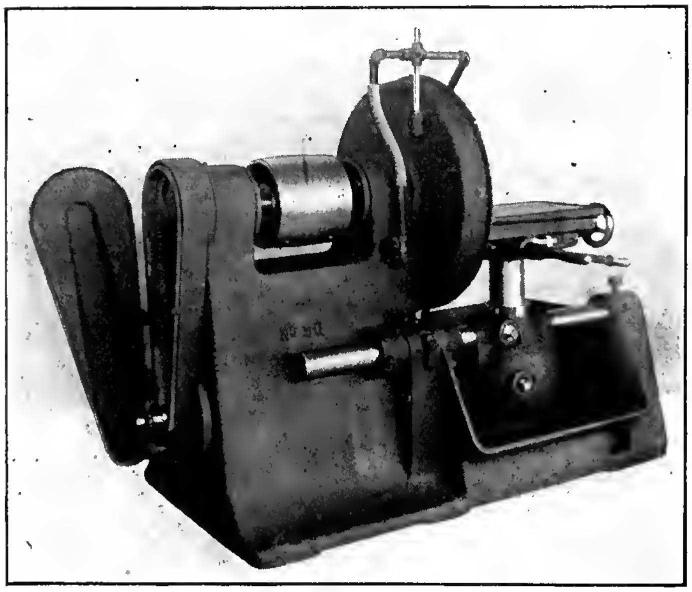
The machine is of unusual weight and rigidity. The total weight, without skids or crating, is 5,000 pounds. The spindle is made from the best crucible steel, turned and accurately ground to 3 inches in diameter. It is mounted in S.K.F. radial ball bearings of larger size than recommended by the manufacturers. The end play is also taken on thrust ball bearings of the same make. The spindle pulley is 12 inches in diameter, with a face for 10-inch double belt. The complete spindle is perfectly balanced and runs without sign of vibration.

The 4-inch diameter rocker shaft and counter weight are a one-piece casting, and weigh in the rough approximately 500 pounds. It is of particular importance to note that the rocker shaft has a

bearing at each end, and that it oscillates in the bearings when the table is rocked back and forth across the grinding wheel. This style of construction results in surpassing stiffness and rigidness, all of which make for greater accuracy and output. When the work being ground is forced against the grinding wheel, it will be understood there would be a tendency for the rocker shaft to move to right in its bearings. The heavy clamp collar just outside of the left bearing prevents this action. The other collar at the right serves two purposes: It is locked to the shaft against the end of the bearing, preventing the shaft from working to the left. The ledge on the under side of this collar and forming a part of it is provided with a curved, elongated slot, which acts around the stop screw. By adjusting this collar on the shaft and locking with the set screw, the limits of the oscillating motion of the table may be regulated.

The table column and top are solidly and rigidly constructed. The column is 5 inches in diameter, and when raised or lowered works within the counterweight, directly over the centre of the rocker shaft. When raised to the required height, it is held in position by the two locking screws passing through the left side of the counterweight. The graduated clamp collar, situated above the counterweight on the column, is employed when it is desired to set the table at an angle with the grinding wheel.

The finished top of the table has three ½-inch T-slots and measures 18 inches long by 10 inches wide. It is surrounded by a depressed channel, with the bottom cast on a down pitch, so that when wet grinding is done the water will rapidly drain into the basin below. The feed mechanism of the table—that is, the travel towards the grinding wheel, is a feature of this machine. Provision is made for either lever, screw or spring feed. When the lever feed is desired, the screw wheel is disengaged by removing a taper pin through its hub, and travel is accomplished by a pinion on the inner end of the lever shaft working in a rack attached to the under side of the table top. By lifting on the lever, a leverage of 56 to 5 is secured. The other handle mounted on the lever shaft, and which projects towards the front is used to assist in rocking the table. The positive screw feed is obtained by replacing the taper pin and turning the hand wheel to the right. A spring pressure of from 1 to 300 pounds can be had by turning up on the screw hand wheel when the latter is disengaged. When the spring feed is employed, the hand lever is used for giving any additional pressure wanted and for locking the table away from the grinding wheel. The micrometer stop screw in front accurately governs the forward movement of the table. The ways for the table top are formed by two heavy, flat gibs, and are thoroughly protected from grit or dust.



A NEW "GARDNER" GRINDER.

It should here be mentioned that this machine carries either a 30-inch diameter by 1¼-inch steel disc wheel or a 20-inch "Perfection" ring wheel chuck. The abrasive ring wheel is used when it is desired to do wet grinding and the disc wheel when dry grinding is done. The cast iron hood terminates at the extreme bottom with two openings, one for water and one for dust. When one of these openings is in use, the other is closed with hinged covers provided. When water is used, it falls into the main basin, from which it overflows into the removable reservoir shown at the rear of the machine. From here it is pumped up through the machine base and out at the adjustable nozzle directly on the work at the point of grinding contact. This water pump is of the gear type, and is driven from the machine spindle by sprockets and chain. The dust exhauster is contained within the machine base and is driven by belt. It is connected to the bottom of hood and discharges at the lower back of the machine. Here a thimble is provided for attaching to pipe. The front of the hood is enclosed with cast iron sections, one or more of which can be removed or inserted, making the opening adjustable for different sizes of work. The chain and belt driving the water pump and exhauster respectively are encased with a cast iron guard having a hinged door.

EFFICIENT USE OF LABOR IN THE FOUNDRY

By J. S.

SINCE the war began the writer has worked in four foundries, all of which have experienced the so-called shortage of labor. In such cases the employer's first thought should be as to whether he could increase the output of the men without overtaxing their strength, by supplying the materials to enable them to work quickly, but how many firms give their moulders or coremakers even all the tackle that should be regarded as necessary?

There are some, but very few founders who realize that a man cannot make his work safe and sound without the necessary tackle, and, moreover, they ignore the fact that tackle needs overhauling and repairing or replacing at times. There are few firms who keep a man to attend to the latter. The foreman or charge hand is perhaps supposed to do this, but the numerous other duties that keep him fully occupied, such as loading and unloading moulding boxes off the stove carriage, finding places to drop them so that they can be cored up and cast, giving jobs out, getting castings out, finding the defects and cause of bad ones, pouring metal when casting time comes round, and other items too numerous to mention that do not come under the heading of moulding or core-making, allow him little time for systematic attention to the men's tackle.

As an instance, two moulders were given employment in a certain foundry and were brought to the foreman or charge hand by a clerk from the office. They were given a pattern to mould, told to "get down here," and shown the box the casting had to be moulded in. The foreman then walked away.

Now, no doubt, these men were entire strangers to the place, and perhaps had not made a casting so heavy for five, ten or twenty years; or, on the other hand, they may have just come from a shop

where they had been on that class of work for years. They rammed the bottom part, turned the box over and proceeded to ram the cores up in green sand. The pattern was for a bed plate of 3 to 4 tons weight, made as a shell pattern to leave its own cores. This system needs a good, strong cast-iron grid to carry the body of sand in the lift, but the men had to make shift with any old cast-iron grid that they could find or make suitable, and these were mostly in halves or with prods off, staples missing, etc., all of which entailed more loose wrought irons.

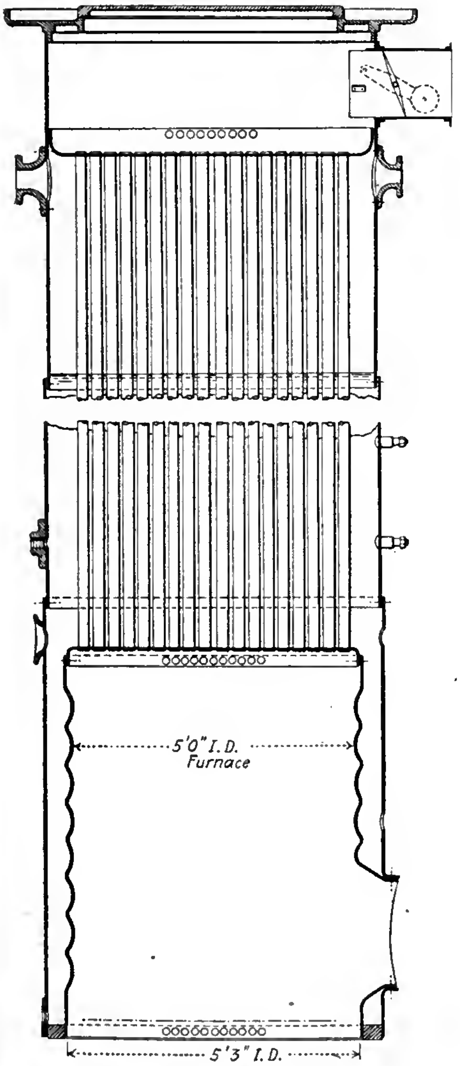


FIG. 1. SIMPLE DESIGN OF VERTICAL BOILER WITH CORRUGATED FURNACE.

In cases like this, where the proper tackle is missing, the moulders often "risk it," and frequently there is a mishap, but who is to blame, the moulder for not using tackle which he had not, and although probably using his best endeavors to make the best of a bad job?

A moulder or core-maker who has acquired the methods of one firm is often not allowed to try them in another shop. In many jobs there is an alternative way that could well be adopted; but it makes a sensible man very cautious in following methods he considers best when the foreman, after the job is well started, pounces down upon him with "have you done this," or "don't do that," and finally orders the job to be started all over again on the customary methods of the firm (which, as a rule, are the foreman's methods), though there may perhaps be no better way than that followed by the new hand.—Foundry Trade Journal.

CORRUGATED FURNACES FOR VERTICAL FIRE TUBE BOILERS.

By F. W. Dean, Boston, Mass.

I HAVE been impressed for many years with the value of corrugated furnaces for vertical boilers, but only recently have actually used them. By the use of such furnaces, staybolts are done away with, and as there appear to be no disadvantages in the furnace this is a most important feature. As many hundreds of staybolts are avoided in each boiler there are just so many less opportunities for breakage and needed repairs. In the staybolted firebox it is necessary for safety to drill holes in the ends of the staybolts in order to know when they are broken.

The simplicity of vertical boilers with corrugated fireboxes must commend them to owners and makers. In the boiler shop the operations of building are of the simplest and most rapid kind. Again this type of firebox provides for expansion and contraction of the tubes in a safe manner, but on account of its somewhat flexible character it should be assumed that it is advisable to support the lower tube plate as near the edge as practicable. The ordinary firebox is rigid vertically and supports the edge of the lower tube plate, but as the corrugated firebox has slight elasticity it is best to hold up as much of the tube plate as practicable by the tubes and provide little or no elasticity in the tube plates. The flat and unstayed portions of the upper and lower tube plates should be made equal in diameter in order to balance.

The flanging of the fire door presents no difficulty, but it should be done so that the corrugations coalesce with the conical part. The behavior of the firebox end of the boiler when under pressure led to some speculation, for the area of the fire door opening theoretically unbalances it. When under hydrostatic pressure, various gauges were used for showing distortion, but none could be discovered.

In regard to sizes of such furnaces the catalogue of an American maker gives 60 in. as the maximum inside diameter, but, as a matter of fact, this concern can make them up to 72 in. diameter, and almost 1 in. thick. They have been made slightly larger in Germany and the furnace of the larger boiler illustrated was obtained in that country. If the inside diameter is 72 in., the grate will be 3 in. larger or 75 in. and the grate area 30.68 sq. ft. It is easy enough to generate 200 h.p. on a grate of this size with considerable capacity for forcing beyond that, and there is no difficulty in providing the heating surface for such horsepower.

In the matter of pressure, a furnace 72 in. in diameter and 0.95 in. thick will carry 200 lb. If there were sufficient demand for larger furnaces they would probably be forthcoming. The theory of heat transmission through plates, and experience, show that thick furnaces, especially if without riveted joints, are objectionable.

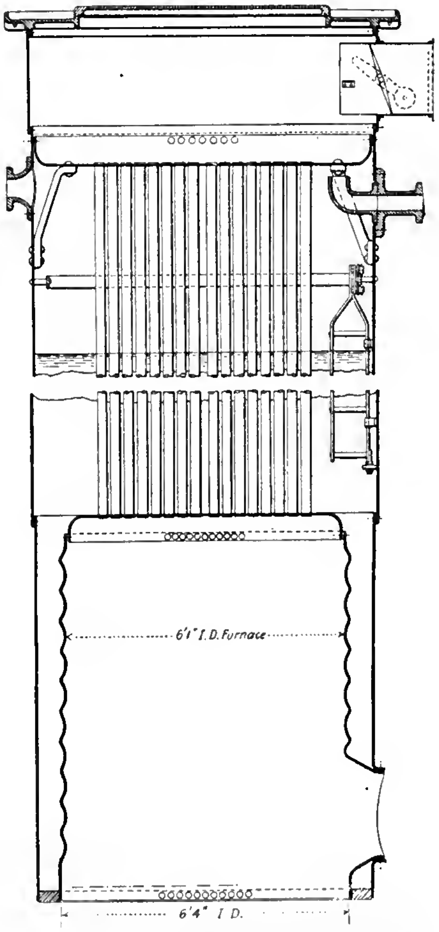


FIG. 2. LARGER BOILER OF THIS DESIGN WITH INTERIOR ACCESSIBLE FOR INSPECTION.

The introduction of corrugated furnaces for the fire boxes of the vertical type of boiler is, I think, a real improvement in steam boilers. The type possesses the important qualities of giving maximum and permanent economy, superheating the steam from 20 deg. to 40 deg., being free from brickwork and requiring small floor space per horsepower.

Fig. 1 shows a boiler of the simplest possible design, two of which have been in use for a year and a half, and Fig. 2 shows one with the interior accessible for inspection and cleaning which has been in use a few months only.

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PEACE-TIME PURSUITS DUE FOR DEVELOPMENT

THE much heralded visit to Canada of D. A. Thomas, the representative of the British Ministry of Munitions did ultimately materialize. Its duration was brief, its programme commonplace and its value problematical. What Mr. Thomas did not know concerning our munitions output and facilities to maintain and enlarge same previous to his advent here were, we should say, comparatively easy of acquirement during his sojourn in our midst. Appearances are rather favorable to a quite generally developing impression that the Thomas visit bears on its face the sole purpose construction—to find out our minimum—with—contentment, so far as the placing of further shell contracts are concerned.

The war is now over thirteen months old and for the major portion of this period Canadian engineering and metal-working plants have been contributing their called-for quota of various type shells. Further, we have organized and equipped to maintain an indefinite quantity supply and have said so earnestly and often. It has, however, seemed to us that compared with the huge orders for war munitions placed in the United States, we were merely crumb gatherers. Organization of interests engaged in shell production gives at once concrete expression to the dissatisfaction felt and to the desire to have opportunity to supplement Empire service by placing increased shell manufacturing capacity at headquarter's disposal. At least two such organizations are in existence, one being representative of our larger engineering and metal-working plants and another of several of our smaller and medium-size plants.

On more than one occasion we have hinted at the probability of shell manufacture in Canada being in the nature of a stop-gap, basing our opinion on the fact of the unpreparedness of British plants to cope with the then demand for shells. The position in Britain, however, is no longer one of unpreparedness. She is nothing short of being one huge ammunition and war supplies factory, equipped with men and machines drawn from every possible source, home and abroad, and organized to ensure an almost self-contained output which will not only last the war, but settle it as she and the worth-while world desires it settled.

Canada and the United States may both take to heart this fact of the war situation, not only as it refers to Great Britain, but to her Allies as well. Men and munitions have been piling up prodigiously these past months, and outputs have been increasing by leaps and bounds. Lloyd George, Britain's Minister of Munitions, is reported to have given out the following statement relative to the latter: Taking the figure 1 as representing the munitions output of British factories in September, 1914, the figure for July, 1915, is 50 times greater. In August, 1915, it will have been 100 times greater and from there onwards the output curve will continue its upward course.

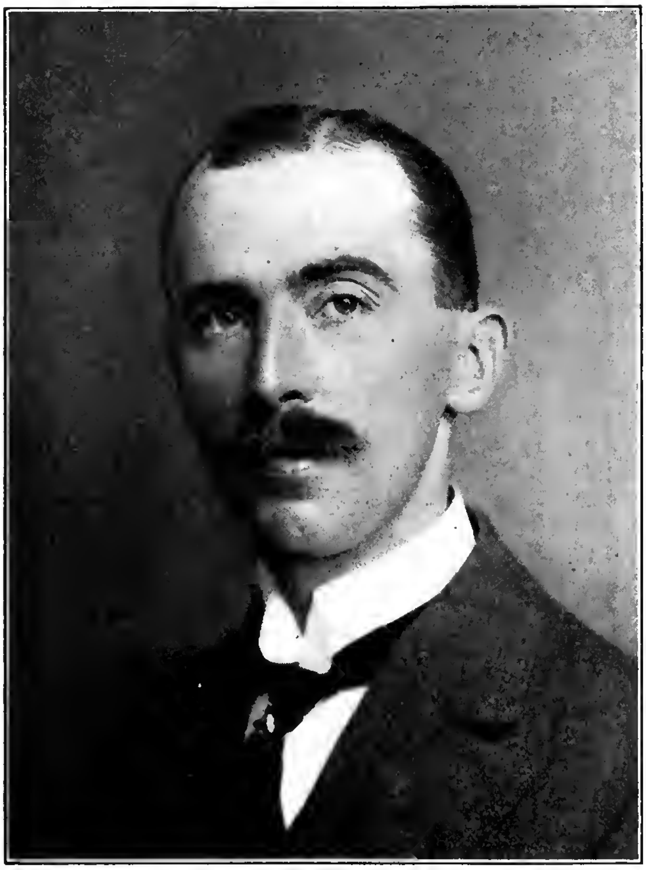
In the past few weeks quite a full realization of the munitions production position in Britain has dawned on the administrations of American financial houses, hence the gallery display of a favorable trade balance while the opportunity is still available. The mission of D. A. Thomas, both here and in the United States, has, we are inclined to believe, been so far as munitions are concerned of a contract-cancelling, stop-order or closing-out nature, and although orders may continue to be placed in both countries while the war lasts, they will be more or less supplemental and comparatively small. In view of this we offer the opinion that contracts will be divided for the most part among the larger and specially equipped Canadian establishments.

Authorities are generally agreed and uncertainty no longer cuts any figure, that an all along the line Canadian crop record has been established. Such a happening in peace or normal times would be the signal for an impetus to every form of industrial and manufacturing development within our borders. A little loosening up here, and a display of old-time enterprise there will easily get good times off to a fair start again. Our engineering and metal-working plant capacity and equipment was never in such shape for handling business—war and peace-time, new and old, home and foreign, and it only needs our big spenders—the railroads to make a beginning, there being the absolute assurance that the little fellows all the way down will quickly join in.

CANADIAN SHIPBUILDERS

THE Collingwood Shipbuilding Co., Ltd., Collingwood, Ont., of which Mr. John S. Leitch is general manager, is one of the most important shipbuilding, engineering and repair plants in Canada, possessing, as it does, two excellent drydocks, commodious building berths with overhead electric crane equipment, engine and boiler shops, foundry and other customary buildings necessary for an up-to-date establishment of its kind. In addition, work is now being carried on night and day producing shells, the company having installed equipment for the manufacture of both shrapnel and high explosive shells.

Mr. Leitch, who is 35 years of age, has been with the Collingwood Company for over three years, and is responsible to the directors for the management of the entire plant. Under his guidance an interesting variety of vessels, with their propelling machinery, has been successfully produced, including such widely different types as 550-foot bulk freighters, powerful bucket ladder dredges for service in the St. Lawrence ship channel, lighthouse and buoy vessels, hopper barges for the Dominion Government services, passenger vessels, etc. Recently an order for two large bulk oil steamers has been secured. It will therefore be seen that the company is enterprising and progressive.



JOHN S. LEITCH.

In addition to new construction, a considerable quantity of repair work is overtaken, the most interesting of the later jobs being the straightening and reconstructing of the large freighter "Howard M. Hanna, Jr.," which came to grief in the memorable gale of November, 1913.

Mr. Leitch, who hails from Portpatrick, in the south of Scotland, gained his technical and practical experience in the three largest British shipbuilding centres, viz., the Clyde, Tyne, and Belfast, having been successively employed by the late firm of Robert Napier & Sons, Glasgow; Swan, Hunter & Wigham Richardson, Neptune Works, Walker-on-Tyne, and Workman, Clark & Co., Ltd., Belfast.

Starting in the shops as an ordinary apprentice, Mr. Leitch has risen rapidly to the highest position in the shipbuilding profession. He resigned from the position of assistant manager with Workman, Clark & Co. in order to take up his appointment in Collingwood

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey forge, Pittsburgh		$14 45
Lake Superior, charcoal, Chicago		16.25
Ferro Nickel pig iron (Soo)		25 00

	Montreal.	Toronto.
Middlesboro, No. 3	22 00	....
Carron, special	23 00	....
Carron, soft	23 00	....
Cleveland, No. 3	22 00	....
Clarence, No. 3	22 50	....
Glengarnock	26 00	....
Summerlee, No. 1	28 00	....
Summerlee, No. 3	27 00	....
Michigan charcoal iron	26 00	....
Victoria, No. 1	23 00	19 00
Victoria, No. 2X	22 00	19 00
Victoria, No. 2 plain	22 00	19 00
Hamilton, No. 1	22 00	19 00
Hamilton, No. 2	22 00	19 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	2.20
Steel bars, f.o.b., Toronto	2.20
Common bar iron, f.o.b., Montreal	2.20
Steel bars, f.o.b., Montreal	2.20
Twisted reinforcing bars	2.20
Bessemer rails, heavy, at mill	1.25
Steel bars, Pittsburgh	1.30
Tank plates, Pittsburgh	1.30
Beams and angles, Pittsburgh	1.30
Steel hoops, Pittsburgh	1.40
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.10
Small shapes	2.35
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.90
Structural shapes	1.95
Plates	1.95

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ¼ to ½ in., 100 lb.	$2 35	$2 25
Heads, per 100 lb.	2 55	2 45
Tank plates, 3-16 in.	2 60	2 45

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$11 00	$11 75
Copper, crucible	12 00	12 50
Copper, unch-bled, heavy	12 00	12 50
Copper, wire, unch-bled.	13 00	13 50
No. 1 machine compos'n	11 00	11 00
No. 1 compos'n turnings	9 00	9 00
No. 1 wrought iron	6 00	6 00
Heavy melting steel	7 00	7 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings	11 00	11 00
No. 1 brass turnings	9 00	9 00
Heavy lead	4 50	4 75
Tea lead	$ 3 25	$ 3 50
Scrap zinc	8 50	9 00

W. I. PIPE DISCOUNTS.

Following are Toronto jobbers' discounts on pipe in effect Aug. 27, 1915:

	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
Standard				
¼, ⅜ in.	63	38½	....	....
½ in.	68	47½	....	....
¾ to 1½ in.	73	52½	....	....
2 in	73	52½	69	48½
2½ to 4 in	73	52½	72	51½
4½, 5, 6 in.	....	....	70	49½
7, 8, 10 in.	....	....	67	44½
X Strong P. E.				
¼, ⅜ in.	56	38½	....	....
½ in.	63	45½	....	....
¾ to 1½ in.	67	49½	....	....
2, 2½, 3 in.	68	50½	....	....
2 in.	....	....	63	45½
2½ to 4 in.	....	....	63	48½
4½, 5, 6 in.	....	....	66	48½
7, 8 in.	....	....	59	39½
XX Strong P. E.				
½ to 2 in.	44	26½	....	....
2½ to 6 in.	....	....	43	25½
7 to 8 in.	....	....	40	20½
Genuine Wrot Iron.				
⅜ in.	57	32½	....	....
½ in.	62	41½	....	....
¾ to 1½ in.	67	46½	....	....
2 in.	67	46½	63	42½
2½, 3 in.	67	46½	66	45½
3½, 4 in.	....	....	66	45½
4½, 5, 6 in.	....	....	63	42½
7, 8 in.	....	....	60	37½

Wrought Nipples.

4 in. and under	77½%
4½ in. and larger	72½%
4 in. and under, running thread.	57½%

Standard Couplings.

4 in. and under	60%
4½ in. and larger	40%

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65%
Sq. Head Set Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45%
Flat & But. Head Cap Screws	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in. N.	70%
Semi-Fin. Nuts up to 1 in.	70%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

METALS.

	Montreal.	Toronto.
Lake copper, carload	$20 00	$19 50
Electrolytic copper	19 75	19 25
Castings, copper	19 00	19 00
Tin	39 00	39 00
Spelter	19 00	19 00
Lead	6 50	6 50
Antimony	40 00	40 00
Aluminum	40 00	40 00

Prices per 100 lbs.

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh	$23 50
Openhearth billets, Pittsburgh	24 00
Forging billets, Pittsburgh	30 00
Wire rods, Pittsburgh	28 00

NAILS AND SPIKES.

Standard steel wire nails, base	$2 40	$2 35
Cut nails	2 50	2 70
Miscellaneous wire nails	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	75
Stove bolts	80
Plate washers	40
Machine bolts, ⅜ and less	70
Machine bolts, 7-16 and over	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes	4¼c per lb. off
Nuts, Hexagon, all sizes	4¾c per lb. off
Iron rivets	72½ per cent.
Boiler rivets, base, ¾-in. and larger	$3.25
Structural rivets, as above	3.25
Wood screws, flathead, bright	85, 10, 7½, 10 p.c. off
Wood screws, flathead, Brass	75 p.c. off
Wood screws, flathead, Bronze	70 p.c. off

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Standard. Price. per ft.	Extra Strong, Sizes Ins.	Extra Strong, Price per ft.	D. Ex. Strong, Size Ins.	D. Ex. Strong, Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	....
7 in	2.38	7 in	3.81	....	....
8 in	2.50	8 in	4.34	....	....
8 in	2.88	9 in	4.90	....	....
9 in	3.45	10 in	5.48	....	....
10 in	3.20	....	....	....	....
10 in	3.50	....	....	....	....
10 in	4.12	....	....	....	....

COKE AND COAL.

Solvay Foundry Coke	$5.75
Connellsville Foundry Coke	4.85-5.15
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

COLD DRAWN STEEL SHAFTING.

At mill	45%
At warehouse	40%

Discounts off new list. Warehouse price at Montreal and Toronto.

MISCELLANEOUS.

Solder, half-and-half	24.75
Putty, 100-lb. drums	2.70
Red dry lead, 100-lb. kegs, per cwt.	9.67
Glue, French medal, per lb.	0.18
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.18
Benzine, single bbls., per gal.	0.18
Pure turpentine, single bbls.	0.62
Linseed oil, raw, single bbls.	0.65
Linseed oil, boiled, single bbls.	0.68
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Lead wool, per lb.	0.10
Pure Manila rope	0.16
Transmission rope, Manila	0.20
Drilling cables, Manila	0.17
Lard oil, per gal.	0.73
Union thread cutting oil	0.60
Imperial quenching oil	0.35

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto 40%

PROOF COIL CHAIN.

1/4 inch	$8.00
5-16 inch	5.35
3/8 inch	4.60
7-16 inch	4.30
1/2 inch	4.05
9-16 inch	4.05
5/8 inch	3.90
3/4 inch	3.85
7/8 inch	3.65
1 inch	3.45

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	60
Carbon over 1½ in.	25
High Speed	40
Blacksmith	60
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Centre	25
Pipe Reamers	80

Discounts off standard list.

IRON PIPE FITTINGS.

Canadian malleable, 35 per cent.; cast iron, 60; standard bushings, 60; headers, 60; flanged unions, 60; malleable bushings, 60; nipples, 75; malleable, lipped unions, 65.

TAPES.

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3.50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$3 00	$2 90
Canada plates, dull, 52 sheets	3 25	3 50
Canada Plates, all bright	4 40	4 60
Apollo brand, 10¾ oz. galvanized	6 40	5 95
Queen's Head, 28 B.W.G.	6 00	6 25
Fleur-de-Lis, 28 B. W. G.	5 75	5 75
Gorbal's Best, No. 28	6 50	6 50
Viking metal, No. 28	6 00	6 00
Colborne Crown, No. 28	5 38	5 30

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$11 00	.....
1¼ in.	11 00	.....
1½ in.	11 00	.....
1¾ in.	11 00	.....
2 in.	11 50	9 20
2¼ in.	13 00	.....
2½ in.	14 00	12 10
3 in.	16 00	12 70
3¼ in.	.....	13 90
3½ in.	20 00	15 00
4 in.	25 50	18 90

Prices per 100 feet, Montreal and Toronto.

WASTE.

WHITE.	Cents per lb.
XXX Extra	0 11
X Grand	0 10½
XLCR	0 09¾
X Empire	0 09
X Press	0 08¼
COLORED.	
Lion	0 07½
Standard	0 06¾
Popular	0 06
Keen	0 05½
WOOL PACKING.	
Arrow	0 16
Axle	0 11
Anvil	0 08
Anchor	0 07
WASHED WIPERS.	
Select White	0 08½
Mixed Colored	0 06¼
Dark Colored	0 05¼

This list subject to trade discount for quantity.

BELTING RUBBER.

Standard	50%
Best grades	30%

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50%
Standard	50 & 10%
Cut leather lacing, No. 1	$1.20
Leather in sides	1.10

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	$9.00
1/4 in.	6.25
5-16 in.	4.65
3/8 in.	4.00
7-16 in.	4.00
1/2 in.	4.00

Prices per 100 lbs.

PLATING CHEMICALS.

Acid, boracic	$ .15
Acid, hydrochloric	.05
Acid, hydrofluoric	.06
Acid, Nitric	.10
Acid, sulphuric	.05
Ammonia, aqua	.08
Ammonium carbonate	.15
Ammonium chloride	.11
Ammonium hydrosulphuret	.35
Ammonium sulphate	.07
Arsenic, white	.10
Copper sulphate	.10
Cyanide of potassium (95 to 96%)	.35
Iron perchloride	.20
Lead acetate	.16
Nickel ammonium sulphate	.10
Nickel carbonate	.50
Nickel sulphate	.20
Potassium carbonate	.40
Potassium sulphide	.30
Silver chloride (per oz.)	.65
Silver nitrate (per oz.)	.45
Sodium bisulphite	.10
Sodium carbonate crystals	.04
Sodium cyanide	.35
Sodium hydrate	.04
Sodium hyposulphite (per 100 lbs.)	3.00
Sodium phosphate	.14
Tin chloride	.45
Zinc chloride	.20
Zinc sulphate	.08

Prices Per Lb. Unless Otherwise Stated.

ANODES.

Nickel	.47 to .52
Cobalt	1.75 to 2.00
Copper	.25 to .28
Tin	.45 to .50
Silver	.55 to .60
Zinc	.30 to .33

Prices Per Lb.

PLATING SUPPLIES.

Polishing wheels, felt	1.50 to 1.75
Polishing wheels, bullneck	.80
Emery in kegs	.4½ to .06
Pumice, ground	.05
Emery glue	.15 to .20
Tripoli composition	.04 to .06
Crocus composition	.04 to .06
Emery composition	.05 to .07
Rouge, silver	.25 to .50
Rouge, nickel and brass	.15 to .25

Prices Per Lb.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents

Toronto, Ont., September 7, 1915.—The Canadian National Exhibition now being held here is exciting considerable interest as usual, and the exhibits in the Machinery Hall are quite up to the standard of previous years, notwithstanding the war. A number of exhibits, as might be expected, feature machinery or materials used in connection with the manufacture of munitions.

The general industrial situation continues to improve, and the large crop which is now practically assured will have a bracing effect in business circles and stimulate domestic trade. The principal development, however, has been recently, and will continue to be in export trade. The expectation of improvement in transportation facilities by increase of tonnage will benefit export trade considerably, it having been handicapped in this respect of late.

Steel Market.

The mills continue working to capacity and the situation in the steel trade is very favorable. This year promises to be a record one for those steel plants who are producing shell forgings and other war material. The business is almost entirely for export, the output being very light for ordinary domestic trade.

The high-speed tool steel situation, is becoming increasingly serious as the demand continues to increase without any corresponding improvement in the supply. Stocks of the sizes most called for are getting very low, and dealers are having the greatest difficulty in filling orders to satisfy everybody as some firms are asking for comparatively large quantities.

Galvanized sheets are firmer following the advance in spelter, but no price changes have been made meanwhile. Makers of galvanized sheets with few exceptions, have either withdrawn from the market or are only quoting on specific tonnages for immediate shipment. The galvanized market is unsettled, and there is little hope of any stability until spelter prices attain fixed level. Prices of galvanized pipe have been reduced following the weakness in the spelter market. The new prices which are given in the selected market quotations represent a reduction of about 10 per cent. The pipe market, however, is unsettled, as the change was decided upon before the recent advance in spelter. If spelter remains at the present level or advances further, higher prices for galvanized pipe may be expected.

Increasing activity prevails in the steel trade in the States and most steel works are now pretty well sold up on their production until the end of the year. The demand for steel rounds for shells is constantly assuming greater proportions, and there is also a heavy demand for barb wire. Prices on bars, plates, and shapes are firmer, and some business has been closed at 1.35c Pittsburgh. Prices on billets are higher, Bessemer being quoted at $23.50, open hearth billets at $24 and forging billets at $30 f.o.b. Pittsburgh. Wire rods have advanced, and are now quoted at $28 Pittsburgh.

Pig Iron.

The market is firm but the general situation is unchanged. There is a good demand for steel-making pig iron, but foundry grades are quieter. Prices are unchanged but firm.

Machine Tools.

The situation in the machine tool market, is much the same as has prevailed during the last few weeks. Many builders of machine tools are in a sold-up condition and deliveries are very backward. There is a fair demand for new tools, and builders of special machines are doing good business. The demand for second-hand tools continues active, principally on account of the difficulty in obtaining quick delivery on new tools.

Supplies.

There is apparently no falling off in the demand for machine supplies and small tools. Prices generally are unchanged but very firm, with the exception of turpentine which has declined two cents and is now quoted at 62 cents per gallon. Prices of leather belting are very firm on account of the scarcity of raw material.

Metals.

There are no important price changes to note this week, and the metal market is steady and firmer. Lead has made a slight advance but prices of all other metals are unchanged. The extraordinary fluctuation in sterling exchange has unsettled the metal market and is having a tendency to restrict business. The general situation, however, is unchanged and business continues good for metals for munitions. The New York Metal Exchange was closed yesterday, being Labor Day.

Tin.—The London Market has advanced slightly, but New York is steady and firm. The fluctuations in sterling exchange are affecting the market and importers are shy at committing themselves to dollar equivalents, and prefer to sell in sterling. Locally tin is unchanged but firm at 39 cents per pound.

Copper.—The market is extremely dull at unchanged prices and there is little of importance to note. The sharp recovery in sterling exchange has greatly improved prospects of export sales. Copper is quoted locally at 19½ cents per pound.

Spelter.—The market for spelter has been restored and good export sales are reported. The market is holding firm, and gives every indication of an advance. Local quotations are unchanged and nominal at 19 cents per pound.

Lead.—The market is firm at the "Trust" price of 4.90c. New York, but domestic enquiry is light. The London market is strong and advancing. Lead has advanced ¼ cent locally, and is now quoted at 6½ cents per pound.

Antimony.—The situation is much the same and the market is quiet. Quotations are unchanged at 40 cents per pound.

Aluminum.—The market is firm and quotations are nominal at 40 cents per pound.

Building Notes

Quebec, Que.—The foundation stone of the new Union Station, was laid by Mayor Drouin, on Aug. 12. H. E. Pringle of Montreal, is the architect.

Vancouver, B.C.—The Department of Public Works, Ottawa, will call tenders shortly on the construction of two large sheds on the new wharf. Approximate cost will be $250,000.

Toronto, Ont.—The Toronto Hydro Electric Commission, 226 Yonge street, are having plans prepared for a sub-station to be erected at St. Lawrence Market, at an estimated cost of $5,000.

Kerrobert, Sask.—Messrs. Badger and Son, of the Badger Flour Mills and Elevator Co., have started work on the construction of a new elevator at this point.

Hamilton, Ont.—Laing & Sons, manufacturing confectioners, have secured a permit for the erection of a factory at 169 and 171 King William street, to cost $8,000. Ground has already been broken for the building.

Winnipeg, Man.—Contractors Hazelton & Webb have been instructed to begin work on the reconstruction of the Scott Block on Main street. Pratt & Ross are the architects and the cost is estimated at $125,000.

Tavistock, Ont.—The Carnegie Library Corporation has agreed to furnish $7,500 for a library in Tavistock, and at the meeting of the council recently it was agreed to provide a site and support the institution to the extent of $750 a year.

From Elevator Manufacture to High Explosive Shells

Staff Article

An outstanding feature of the series of articles being published in these columns on "Shell Manufacture in Canada," and one which is emphasized on each succeeding occasion is that no sphere of mechanical engineering enterprise however far removed its particular product may have been from that of shell making has held aloof from or hesitated to grip the opportunity offered by the latter in all of its variety features. The plant here described is eminently typical of what has been accomplished in the direction above indicated.

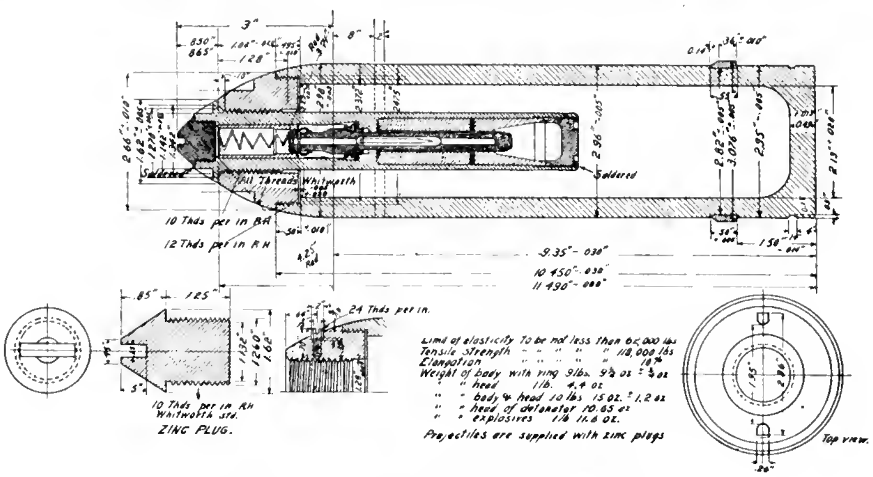
ONE of the chief essentials to maximum output of almost any manufactured article is the employment of special machinery and tools. To meet the requirements of many products the manufacturer, in most cases, must equip his plant with modern, up-to date machinery in order to compete with others, who may be employed in making the same or a similar commodity. In the equipping and perfecting of a plant that is to be used in making some permanent line of manufactured product the need of special machinery is not only an advantage but essentially a necessity.

In the manufacture of shrapnel and high explosive shells the manufacturer must, owing to the impossibility of procuring the desired machines and equipment, devise ways and means whereby he can utilize to the best advantage such tools as happen to be at his immediate disposal.

To get best results, when it is practically impossible to procure suitable machinery, owing to the abnormal demand, the greatest ingenuity must be displayed by those who are called upon to solve each individual problem as it arises, or anticipate them. In no other industry perhaps is this more evident than in the manufacture of shells of the various types.

FIG. 1. ROUGH TURNING SHELL BODIES.

The demand for an increased output of these indispensable pieces of mechanism is so great and our various manufactures are so keen about supplying this demand that more often than not they do not wait until they can be supplied with necessary equipment, but turn to and successfully meet the issue by designing tools and devices that in many cases more than fulfil their most sanguine expectations.



RUSSIAN 3-IN. HIGH EXPLOSIVE SHELL.

The plant description which follows gives a very good illustration of what can be accomplished in the way of overcoming production obstacles, for while it is true that a few new tools were almost absolutely necessary, the greater proportion of the different operations is being done on previously installed machines fitted up with special attachments designed and applied by those in charge of the institution.

Great credit is due to men of the calibre that refuses to be told, or even to think, that certain things are impossible. To meet and overcome the obstacles arising from the inception of a new industry, shows the sincerity of purpose back of the procuring of an order for shells, particularly when time does not allow the delay in waiting delivery of the necessary new equipment.

While the general sequence of operations in the manufacture of the various makes of shells is somewhat similar, the methods devised by the various manufacturers must necessarily differ owing to the class of work to which their particular equipment has formerly been adapted.

The machine tools that would find their home in a large engine plant would not conform to those found in the plant under review, its specialty in normal times being the production of electric elevators.

When various industries, each equipped with their particular line of machinery for the output of their special needs are called upon to manufacture the one special article in unrestricted quantities it requires a ready and active mind to produce results on the machines and tools at their disposal. This particular plant which is now manufacturing the Russian 3 in. high explosive shell has applied to the existent machine tools special devices that are successfully accomplishing what might have been deemed impossible a year ago.

Centering and Roughing.

To fully describe the various useful appliances, the process of manufacture will briefly be dealt with. The rough forging which is secured from the United States Steel Products Co. is first centered on the base, and then taken to a Boye &

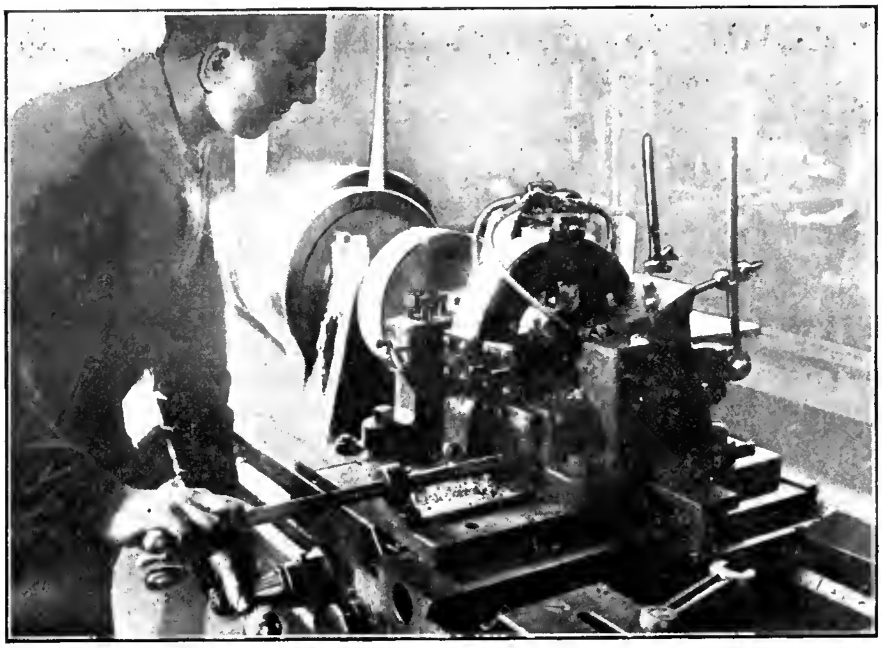


FIG. 2. GROOVING, UNDERCUTTING, KNURLING AND FACING.

Emmes Machine Co. lathe, also to an old "Butler" lathe. A plug is driven into the open end and the shell is placed upon the centres and rough turned as shown in Fig. 1.

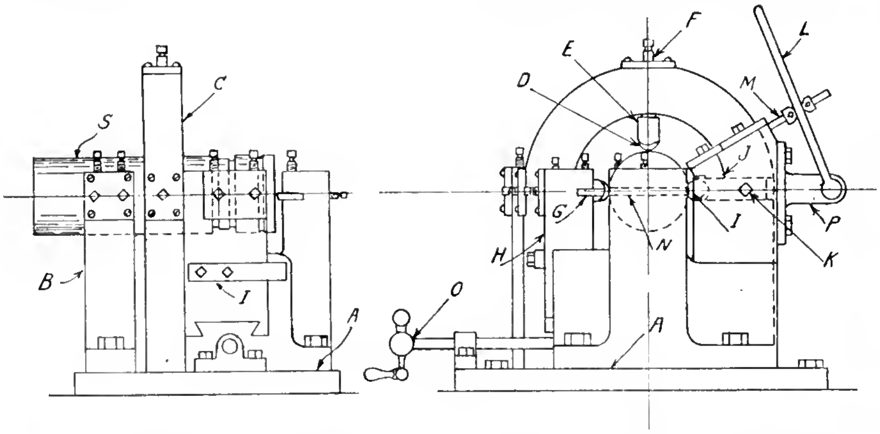


FIG. 3. GROOVING, UNDERCUTTING, KNURLING AND FACING ATTACHMENT.

Grooving, Undercutting and Knurling.

The grooving, undercutting and knurling, also facing the base is performed on a "McDougall" lathe, which is shown in Fig. 2. This operation and the device that accomplishes it indicate the ingenuity of those who have taken in hand the responsibility of production. Fig. 3 shows a rough sketch of the device which originally was intended also to rough turn the body, but on account of the low limit allowance on these shells and the possibility of tearing and marking, the roughing is done previous to this and the other operation done separately.

The main casting A of the device is bolted to the saddle of the lathe, the piece B being for the roughing operation but, owing to the possible faults already stated, was dispensed with. The steady rest C is used to hold the rollers D which are carried in the forked pieces E, these being adjustable by the set screws F. The groove for the copper band and also that for the cartridge case is put in by the tool G held in the casting H. The knurl is done by the small knurl I held in the piece J and secured by the set screw K. While the knurl is in position the undercutting is performed by the two levers L which operate the tools M through slides planed at the desired angle; this can be more clearly seen in the illustration. The end of the shell is faced off with the tool N, and the motion of the tools is derived from the feed handle O. The shell during the operation is held in a split chuck.

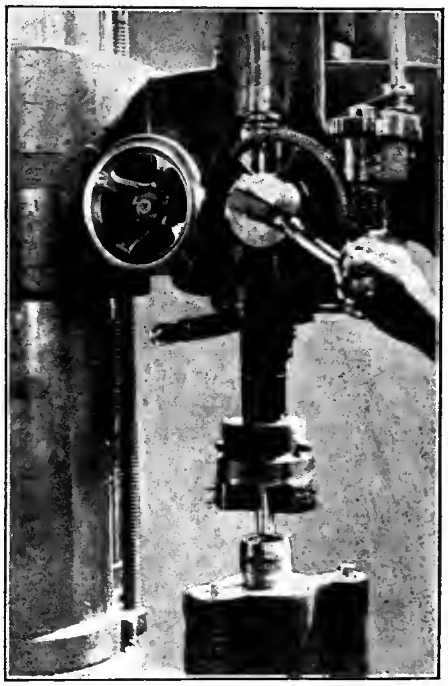


FIG. 4. NOSING OPERATION.

Nosing.

The nosing is performed on an old drilling machine shown in Fig. 4. The work is held in a clamp chuck secured in a fixed position on the drill press table. The cutter head is brought down and the contour of the nose formed by the three forming cutters secured in position in the cutter head.

Boring.

The boring of the shell is accomplished on an old "Gardner" double headed lathe, shown in Fig. 5; the cutting bar being held in position on the tool post of the saddle and a shell placed in the chuck of each head. While the cutting tool is operating on one shell the operator is removing the completed shell from the opposite head and securing another in

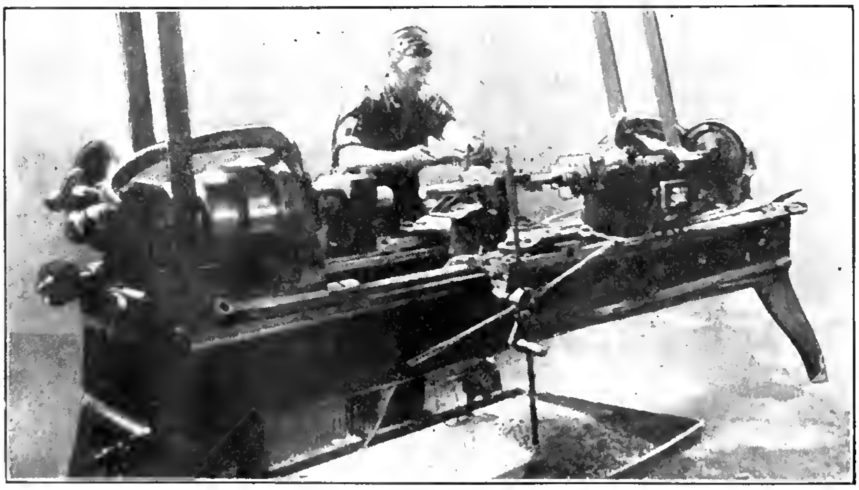


FIG. 5. BORING OPERATION ON DOUBLE HEAD "GARDNER" LATHE.

the chuck in readiness. The cutting operation is therefore almost continuous except for the time taken to change the direction of the traverse of the saddle and in running the latter from one head to the other.

As this particular shell requires a taper of 1/10 of an inch in the length of the bore, the cutting tools in the boring bar are at the top of the bar, and the rear end of each head is elevated sufficiently to give the required taper.

Base of Bore.

Another interesting operation is the forming of the radius at the base of the bore. Owing to the finish required upon these shells it was thought advisable to accomplish this result in the manner shown in Fig. 6. The two machines shown were designed by the superintendent of and built by the A. B. See Elevator Co., Montreal, with the expectations that as the cuttings were free to fall away from the cutting tool, better results would be obtained. The work produced was entirely satisfactory with the exception that the operator might with a little carelessness exert undue pressure upon the feed levers and cause the cutting tool to dig in and tear the stock. The device shown in the sketch, Fig. 7 was designed to offset any such contingency.

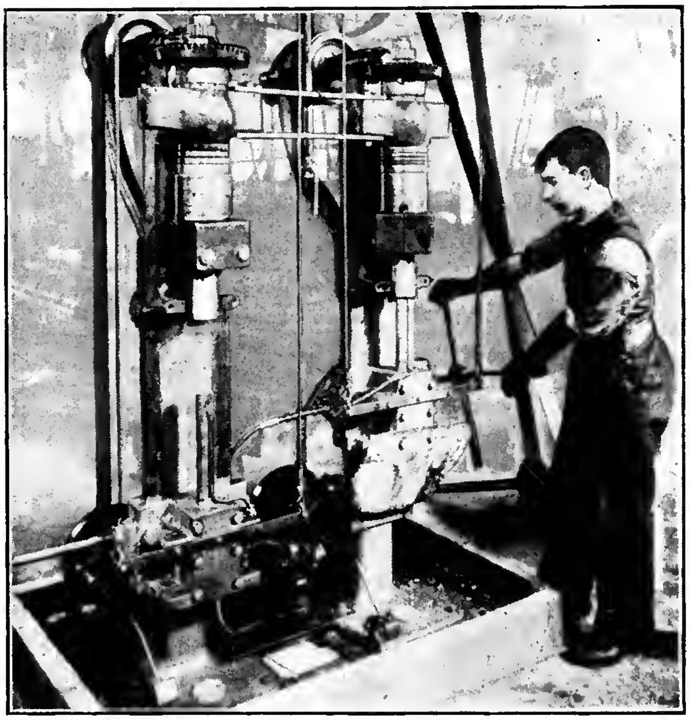


FIG. 6. FORMING BASE OF BORE RADIUS.

Two small cylinders B were bolted to the bottom of the moveable drill table A, and moveable pistons C were placed in these cylinders with an extending piece D. To operate the device, the shell being secured in the chuck shown, the machine is started and the drill raised by hand with the lever H. When about one inch from the bottom, or, when the drill began to cut, the piece E which moved freely on the base of the machine is swung beneath the piece D and the air turned on gradually. The air coming through the port I against the piston C forces the cylinder, and, therefore, the drill up to the work, allowing the chips to fall freely as the operation progresses. A jet of cutting compound is continually forced up alongside the drill, and a pressure of 80 to 100 lbs. per sq. in. is used, giving a raising force of about 700 lbs. to 900 lbs. The pistons used were obtained from the Ford Motor Co.

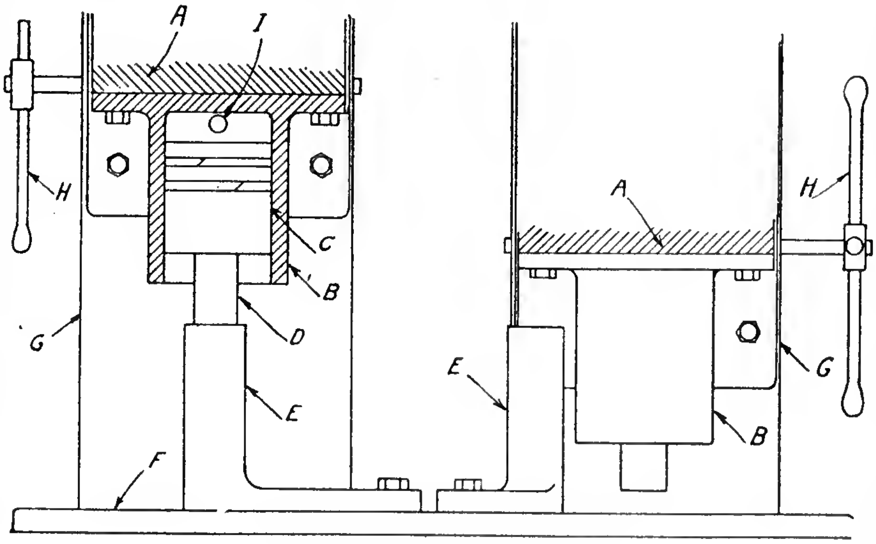


FIG. 7. AIR FEED FOR DRILL.

Cutting Compound.

The cutting compound required in the various operations is forced to the work by means of a small gear pump shown in Fig. 12. The frame A is secured in position on the floor at the rear of the machine so that the pulley B will be below a moveable shaft on the machine around which is placed the driving belt C. The cutting compound drips into a large pan beneath the machine and is there drawn through the hose D by action of the pump and forced up through the hose E to the work.

Heat Treating.

The heat treating process on these shell is in accordance with prepared specifications as follows:

A—Heat slowly in furnace to 850 degrees C., or 1562 F.

B—Hold to this temperature for fifteen minutes.

C—Plunge into water of a temperature of about 62 degrees C. or 142 F.

D—Allow shell to cool in the water.

E—Leave shell in the air until thoroughly dried.

F—Afterwards immerse in a bath of lead at a temperature of about 500 degrees C. or 932 F, and allow to remain for about fifteen minutes.

G—Remove shell from lead bath and allow to cool in the air.

The first heating is done in two Mechanical Engineering Co. furnaces, and the cooling is done in a tank about 4 ft. x 5 ft. x 3 ft. deep. To retain the water at the proper temperature required, some very thoughtful consideration was given and experimenting done, the following procedure being adopted as a result.

Cold water is allowed to enter into the tank through a pipe which has its opening near the bottom of the tank, and the heated water is drawn off from near the surface. To regulate this flow of water, the following interesting and possibly original contrivance is used. An ordinary alarm clock was requisitioned and on the wheel that operates the second-hand, several pieces were arranged so that intermittent contact could be made at intervals of from a few seconds to a minute. When this contact is made, the current is transmitted to coils which, with other arrangements, operate a lever which releases a foot valve and allows a certain amount of heated water to flow from the tank.

As the heating of the shells and the lacquering are done in two separate, temporary buildings, the heated water from the hardening tank is forced through coils placed around the lacquering building for the purpose of keeping it warm in cold weather. The furnace for tem-

pering in the lead bath is shown to the extreme left in Fig. 8.

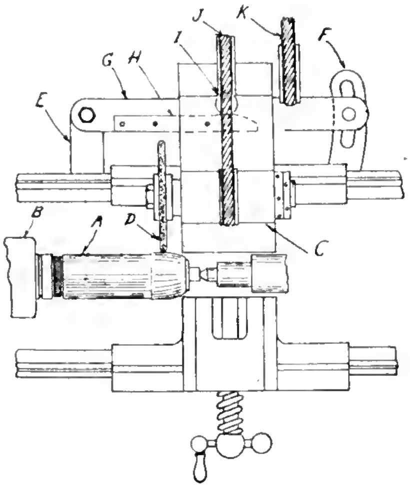


FIG. 9 EXTERNAL GRINDING.

Grinding.

After the hardening it is found necessary to grind both the bore and the outside to bring the shells down to weight also to put the finish on contour of nose. The exterior grinding is done on an old lathe fitted up with taper attachment, Fig. 9. The piece C is secured to the cross-slide of the lathe, and carries the arbor which holds the cutting wheel D which is driven by means of the belt J running over the grooved pulleys, the belt K being driven from a shaft overhead. The cam H which is shaped to suit the form of the nose contour is secured to the bar G which is fitted to the brackets E and F. The roller I which is secured to the base of piece C is held in contact with the cam H by means of the spring on cross-feed spindle.

The internal grinding is accomplished on an old flat turret lathe, the shell A being held in the split chuck B. The adjustable cross slide S is secured to the traverse slide of the turret which is advanced by means of the levers G and the pinion shown which meshes with a rack below the slide. The arbor is driven by means of the groove pulley F. To accommodate the taper of the bore the head is set over the desired amount. Fig. 10 shows a sketch of this device.

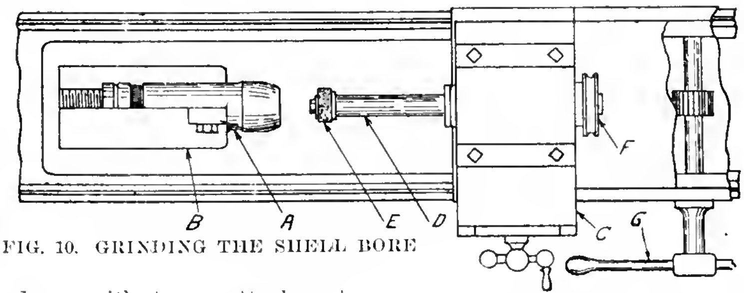


FIG. 10. GRINDING THE SHELL BORE

Lacquering.

A very interesting and original idea for lacquering the exterior of the shells is shown in Fig. 11. The shells have to be coated with a thin even layer of lacquer, and to do this with any degree of satisfaction seemed to be quite a proposition as no ridges or unevenness must appear on the finished shell.

The sketch Fig. 11 shows the method adopted to meet the demand in view. A heavy galvanized iron tank about 2 feet square and 2 feet deep has been constructed and secured in a wooden frame. Half way down the tank B is the partition C which divides the tank into two compartments. From a 2 inch opening in the centre of this partition C, the pipe

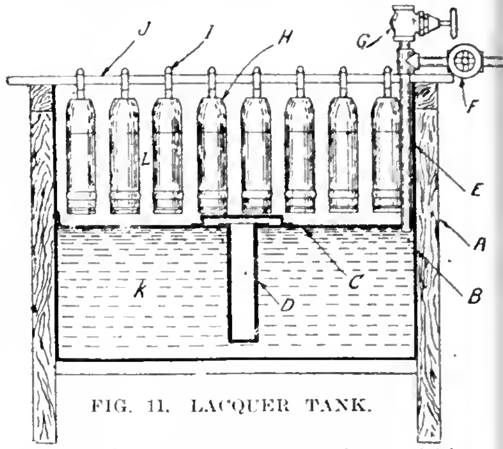


FIG. 11. LACQUER TANK.

or tube D extends downward to within about one inch of the bottom. Down one corner of the tank the air pipe E extends and just enters the bottom compartment. This joint, as well as all the others is made completely air or water tight. The operation of the arrangement is as follows:—

The compartment K is filled with the lacquering fluid and the shells are allowed to hang down supported on a bar which passes through suitable pieces screwed in the nose of each shell. When the shells are placed in position, the valve F, which controls the air from the reservoir, is opened and the air passing through the pipe E to the surface of the liquid forces the lacquer up through the tube D and gradually floods the upper compartment. When the lacquer has

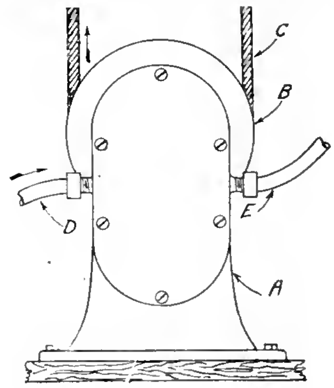


FIG 12. FORCE PUMP.

completely flooded the shells, the valve F is closed and the fluid allowed to remain for a time, or it can be permitted to recede with any degree of rapidity by opening the exhaust valve G, thereby allowing the air to escape and the fluid to re-enter the lower compartment. An uniformly even coating of lacquer on the surface of the shells is the result. The diaphragm M is added to evenly distribute the flow of lacquer.

To prevent the lacquer from adhering to the copper band the latter is coated with a solution which is removed after the shell lacquer has set.

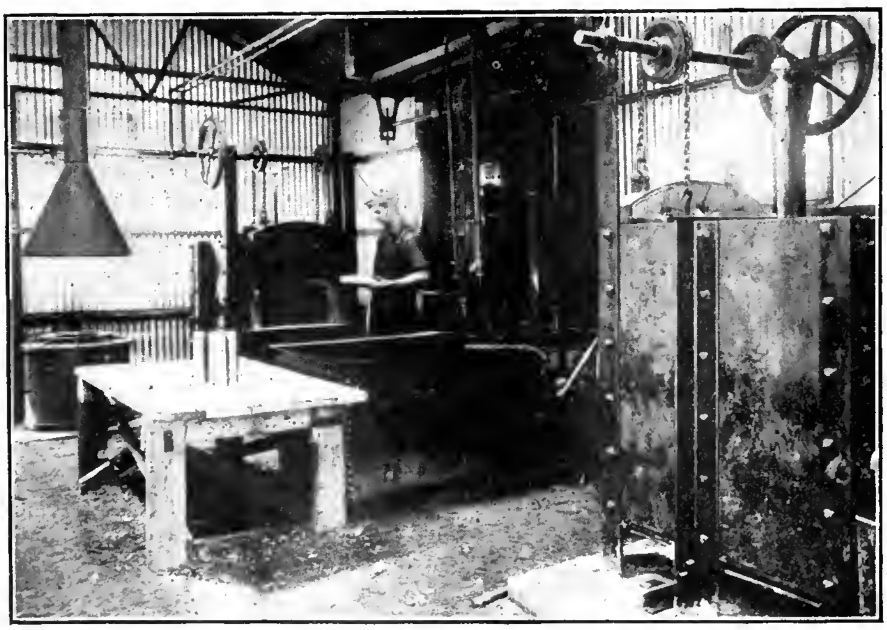


FIG. 8. HEAT TREATING ROOM.

PRODUCTION METHODS AND DEVICES

A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

THREE TYPES OF SPRING TESTERS

By G. Edwards

THE springs used for automobile motor valves must be of a comparatively uniform tension in order to give satisfactory service. For this reason, nearly every motor factory has some kind of testing device for testing the power of the springs used. If too stiff or too weak, they must be discarded. Many of the testing devices make use of a standard scale to do the measuring of the spring power.

The one shown in Fig. 1 employs a common counter scale around which a wooden frame has been placed. A screw A and the handwheel B form the means of compressing the spring onto the scale platform. The spring is placed as shown at C and the screw is run down a certain distance. The scale should then "weigh" a certain amount, with an allowance for plus or minus, which has been determined previously and tabulated for the operator's use. The device shown is somewhat slow and cumbersome for any but heavy springs.

That shown in Fig. 2 is easier to use and has a wider range. The wooden fulcrum-bracket bolted to the wall has a number of holes in it for various positions of the compression lever when testing springs of different lengths. The spring to be tested is placed at A and the lever B is brought down as far as the slot in the guide C will allow it to go. The reading is taken from the scale beam as in the previous case. In using this device, care is taken to place the springs under the same spot on the lever, so that the amount of compression and the leverage does not vary to any extent. This device is in use in one of the largest automobile factories in the country.

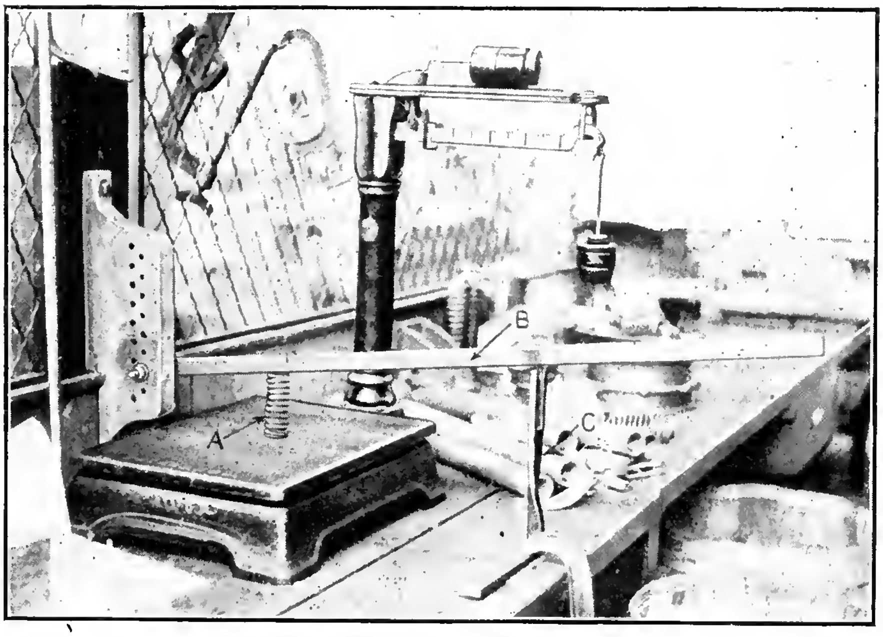


FIG. 2. DEVICE WITH WIDER RANGE.

Another device that is extremely sim-

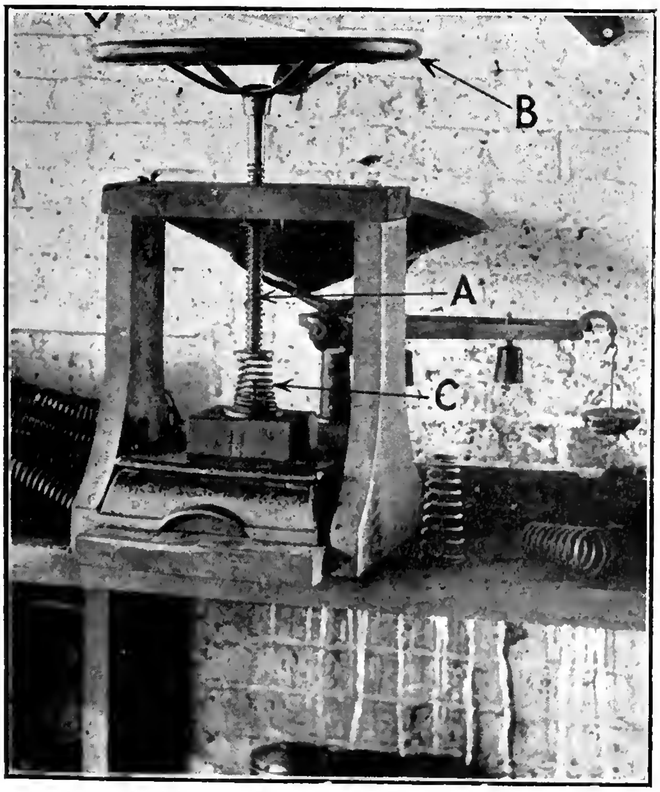


FIG. 1. SCREW-OPERATED SPRING TESTER.

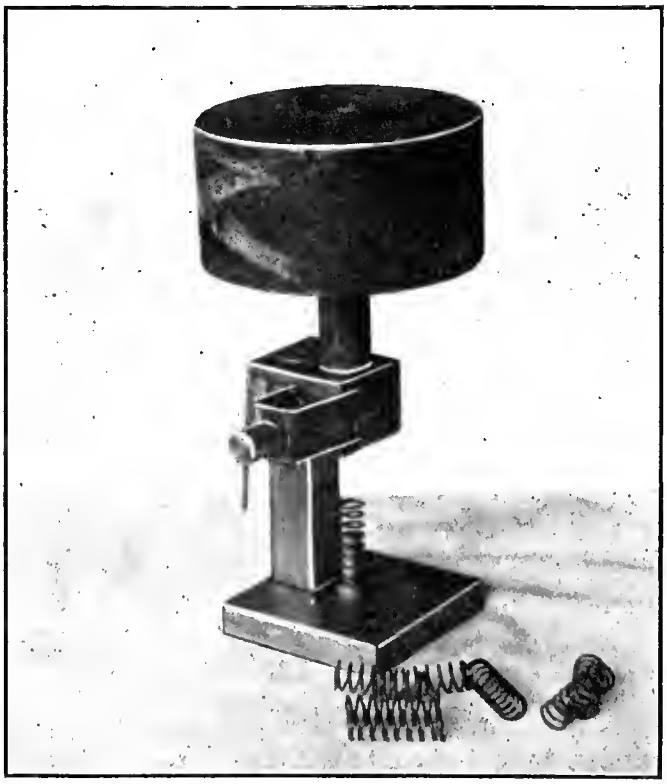


FIG. 3. SIMPLE TESTER.

ple, and does not employ a scale, is shown in Fig. 3. It is used for testing the springs used on a well-known motorcycle. The spring is placed over the locating spring as shown. The weight is then released so that the plunger will come down on top of the spring, the latter having strength enough to just keep the bottom of the plunger from coming in contact with the top of the locating pin. This is adaptable to a large range of work with a few modifications, the principal requirement being suitable weights for various springs. It also has the advantage of being easily made by almost anyone at a slight cost.

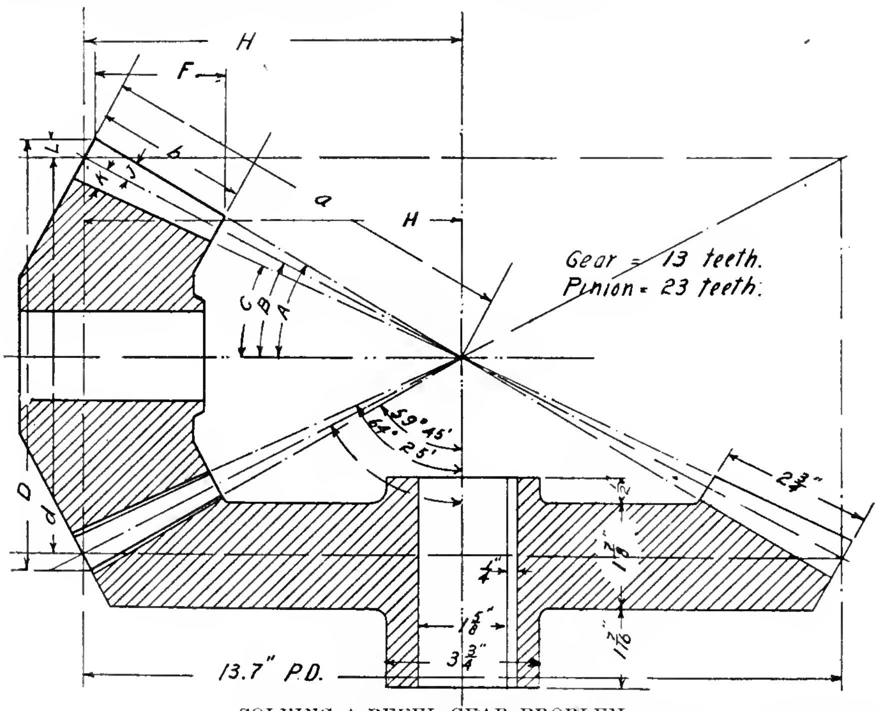
SOLVING A BEVEL GEAR PROBLEM.

By L. E. Gehman.

A jobbing shop received a repair order for a bevel gear and pinion, which called for cut gears and further stated that the original gears had been shipped by express.

The gear arrived in due time but the pinion could not be located. The job was a very urgent one so it was turned over to the draftsman who was informed that he should be able to make a drawing of both gear and pinion from the data which could be secured from the gear.

The gear had 43 teeth and the circular pitch was found to be approximately one inch. The face and cutting angles were next measured by a bevel protractor using the bore of the gear as a finished surface for the protractor. The face angle measured 64° 25′ and the cutting angle 59° 45′, approximately. To get the approximate centre angle one-half of the difference between the cutting and face angles were added to the cutting angle which gave 62° 5′. The outside diameter calipered 14 in., and the pitch diameter 13.7 in.



SOLVING A BEVEL GEAR PROBLEM.
DATA: 43 TEETH, O.D. 14 INS., P.D. 13.7 INS., PITCH 1 IN., CUTTING ANGLE 59° 45′, FACE ANGLE 64° 25′.

The notation and formulas that were used were as follows:

N=Number of teeth in gear.
n=Number of teeth in pinion.
A=Face angle.
B=Centre angle.
D=Outside diameter.
F=Face measured parallel with the axis.
H=Distance from pitch line to the apex parallel with the axis.
a=Distance from the apex of angle to the point of tooth.
b=Length of face.
d=Pitch diameter.
p=Circular pitch.
J=Difference in degrees between the centre angle and face angle.
K=Difference in degrees between the centre angle and cutting angle.
L=Distance from point of tooth to pitch line measured perpendicular to axis.

Calculating for the pitch diameter.

$$d = \frac{NP}{3.1416''} = \frac{43 \times 1}{3.1416''} = 13.687 \text{ in.}$$

which is very near the approximate dimension. In order to figure the angles it was necessary to know the number of teeth in the pinion. Thus using the centre angle 62° 5′ and the formula $\text{Tan.} = \frac{N}{n}$. Solving for the number of teeth in pinion, $n = \frac{N}{\text{Tan. B}} = \frac{43}{1.88734} = 22.7+$.

Assuming that the pinion has 23 teeth and solving for centre angle; $\text{Tan. B} = \frac{43}{23} = \text{Tan. } 1.86957 = 61° \ 51' \ 30''$.

Solving for 22 teeth $\text{Tan. B} = \frac{43}{22} = \text{Tan. } 1.95454 = 62° \ 54' \ 18.8''$. Comparing these results with the approximate centre angle, it is found that the centre angle of the pinion with 22 teeth is 49′ 18″ greater, and the pinion with 23 teeth 13.5″ smaller, than the centre angle, therefore it can be readily seen that the original pinion had 23 teeth.

In calculating the face and cutting angles it is necessary to know the angles J and K and the distance from the apex of the angle to the point of the tooth, parallel with the face of the tooth:—

$$a = \frac{d}{2 \text{ sine B}} = \frac{13.687}{2 \times .88178} = \frac{13.687}{1.76356} = 7.761 \text{ in.}$$

$$\text{Tan. J} = \frac{\text{Addendum}}{a} = \frac{.3183}{7.761} = .04101 = 2° \ 20' \ 54''.$$

$$\text{Tan K} \frac{\text{Dedendum}}{a} = \frac{.3683}{7.761} = .0475 = 2° \ 43'.$$

Face angle $A = B + J = 61° \ 51' \ 30'' + 2° \ 20' \ 54'' = 64° \ 12' \ 24''$.

Cutting angle $C = B - K = 61° \ 51' \ 30'' - 2043' = 59° \ 8' \ 30''$.

The calculated angles and approximate angles are very nearly the same.

The distance H from the pitch line to the apex, parallel with the axis

$$= d \times \frac{\text{cosine B}}{2} = \frac{13.687 \times .53489}{2} = 3.6605.$$

The face measured parallel with the axis $= F = b \times \text{Cos. } A = 2.75 \times \text{Cos. } 64° \ 12' \ 24'' = 2.75 \times .43511 = 1.197''$.

The distance $L = \text{addendum} \times \text{Cos. B} = .3183 \times .47166 = .150$.

Outside dia. $D = d + 2L = 13.687 + .30 = 13.987$.

From the foregoing dimensions a drawing was made, the number of teeth for the pinion being 23, and the pitch diameter twice the distance from the pitch line of the gear to the apex of the angle measured parallel with the axis. The other dimensions being calculated with similar formulæ that were used for the gear and the length of the hub was taken from the machine.

The Coming Foundrymen's Convention and Exhibition

The privilege of spending a week in Atlantic City with its health-bracing and pleasure-giving opportunities may at any time be considered acceptable. There is, therefore, little doubt that, with the added features of a thoroughly installed and attractively displayed exhibition of foundry equipment and supplies, and an unusually high-grade programme of interesting and instructive work-a-day topics aranged for discourse and discussion, foundrymen from all over the United States and Canada will make their presence felt on this occasion in numbers greatly exceeding those of even the most successful of past similar functions.

THE selection of Atlantic City, N.J., as the meeting place for the 1915 Annual Convention of the American Foundrymen's Association and of the American Institute of Metals may justly be stated as a happy choice. The fact also that the Foundry & Machine Co. Exhibition is again found in co-operation leaves nothing to be desired by even the most fastidious or critical. It has been stated—and with more real truth than the mere words express—that the whole eastern section of the country have united as hosts to return the hospitality tendered at similar functions held in recent years in Toronto, Detroit, Cincinnati, Pittsburgh, Buffalo, and Chicago. This is clearly indicated by the fact that the local committee is formed of prominent foundrymen, chosen from the States of Pennsylvania, New Jersey, New York, Connecticut, Rhode Island and Massachusetts.

Its central location and excellent transportation facilities make Atlantic City easily accessible, while its proximity to Philadelphia and New York, in which districts are to be found many large and varied foundry establishments, gives unlimited scope and opportunity to such as may desire to visit and inspect lay-out and operation systems with which they may be unfamiliar, but by which they may profit. At the various sessions of the American Foundrymen's Association and the American Institute of Metals 63 papers and reports will be presented and discussed. In quality and variety the papers are fully equal to those presented at previous meetings and the programmes have been arranged to stimulate the fullest possible discussion.

Both societies will hear the reports of committees that have been at work throughout the year, and it is expected that an unusual volume of valuable foundry information and data will become available through this source. The exhibition will have the advantage of an ideal location which precludes the possibility of overcrowing and inconvenience and affords unusual facilities for the display of working equipment. The entertainment features of the week will be unique and of a character such as can only be found at Atlantic City.

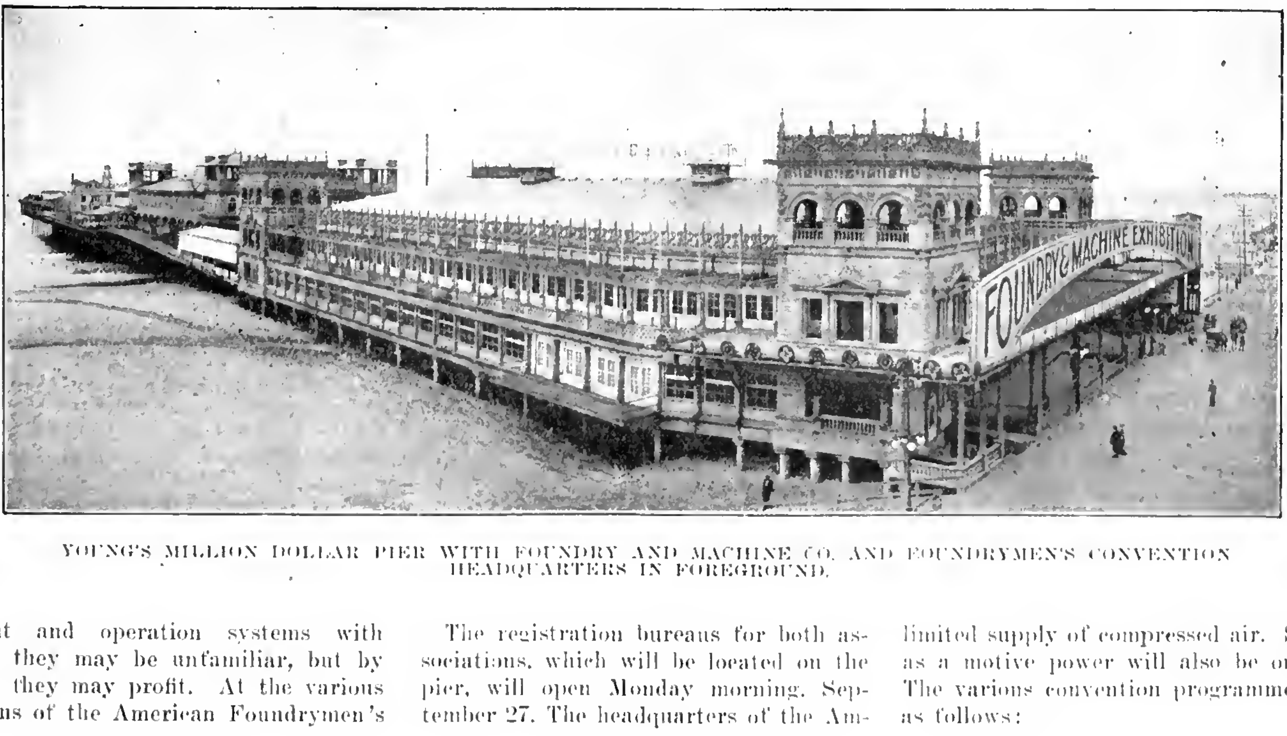
The tenth annual foundry and machine exhibition, under the auspices of the Foundry & Machine Exhibition Co., will open Saturday morning, September 25, and close Friday evening, October 1. The convention proceedings will open at 10 a.m. Tuesday, September 28, with a joint meeting of the American Foundrymen's Association and the American Institute of Metals.

The registration bureaus for both associations, which will be located on the pier, will open Monday morning, September 27. The headquarters of the American Foundrymen's Association and the American Institute of Metals will be at the Hotel Traymore, the latest addition to Atlantic City's galaxy of hostelries. The headquarters for the Machine & Exhibition Co. will be at the Hotel Dennis.

Thursday, September 30, has been set aside as "Philadelphia Day" and an effort will be made to close all Philadelphia foundries on that day to enable the employees to attend the convention and exhibition. The annual joint banquet of the American Foundrymen's Association and the American Institute of Metals will be held Thursday evening, September 30, in order to give as many of the Philadelphia visitors as possible an opportunity to attend.

The American Foundrymen's Association will introduce an innovation by holding its annual business meeting on Wednesday evening, September 29, instead of on Friday morning as heretofore.

Exceptional facilities are, we understand, being provided for operating exhibits. Electric current, both direct and alternating, will be available at various voltages, while exhibitors of pneumatic machinery will have as usual an unlimited supply of compressed air. Steam as a motive power will also be on tap. The various convention programmes are as follows:



YOUNG'S MILLION DOLLAR PIER WITH FOUNDRY AND MACHINE CO. AND FOUNDRYMEN'S CONVENTION HEADQUARTERS IN FOREGROUND.

American Foundrymen's Association

TUESDAY, Sept. 28, 10 a.m. CONVENTION HALL

Joint session, American Foundrymen's Association and American Institute of Metals.

Addresses of welcome and response.

Report of A. F. A. committee on safety, by A. W. Gregg, chairman, Bucyrus Co., South Milwaukee, Wis.

"Tests of Lenses for Foundry Goggles," by F. W. King, Julius King Optical Co., New York. This address will be accompanied by a demonstration of a lens testing machine and a colored spectroscopic test showing scientifically, colors of lenses used in dangerous conditions of light and glare.

Report of A. F. A. committee on industrial education, by Frank M. Leavitt, chairman, University of Chicago, Chicago.

"Functions of Sand Binders," by Henry M. Lane, consulting foundry engineer, Trussed Concrete Bldg., Detroit.

"Notes on Applications and Characteristics of Cores in Modern Molding," by R. A. Bull, Commonwealth Steel Co., Granite City, Ill.

"Molding Sands," by C. P. Karr, associate physicist, Bureau of Standards, Washington, D.C.

Appointments of nominating and resolutions committees.

TUESDAY, SEPT. 28, 2.30 p.m. CONVENTION HALL

Report of A. F. A. committee on specifications for foundry scrap, by S. D. Sleeth, chairman, Westinghouse Air Brake Co., Wilmerding, Pa.

"Patternmaking for Molding Machine Work," of The Fire Engineer, and Harry Y. Carson, Central Foundry Co., New York.

WEDNESDAY, SEPT. 29, 2.30 p.m. CONVENTION HALL

Gray Iron Session

"Pouring Systems for Gray Iron Foundries," by H. Cole Estep, associate editor, The Foundry, Cleveland.

"Fuel Oil Cupolas," by Bradley Stoughton, consulting metallurgical engineer, New York City.

"Inspection of Automobile Castings," by C. B. Wilson, Wilson Foundry & Machine Co., Pontiac, Mich.

"Common Defects in Gray Iron Castings—Their Causes and Remedies Therefor," by Herbert M. Ramp, Elmwood Castings Co., Cincinnati.

Report of A. F. A. committee on specifications for gray iron castings, by W. D. Putnam, chairman, Detroit Testing Laboratory, Detroit.

Report of A. F. A. committee on standard methods for analyzing coke, by H. E. Diller, chairman, General Electric Co., Erie, Pa.

WEDNESDAY, SEPT. 29, 8 p.m., HOTEL TRAYMORE

Annual Business Session

Annual address of the president, R. A. Bull, Commonwealth Steel Co., Granite City, Ill.

Report of the secretary-treasurer, A. O. Backert, Cleveland.

Report of the auditor.

Report of the nominating committee.

Election of officers.

BEACH SCENE, ATLANTIC CITY.

by E. I. Chase, Cadillac Motor Car Co., Detroit.

"Foundations for Jar-Ramming Molding Machines," by E. S. Carman, Osborn Mfg. Co., Cleveland.

"The History and Development of the Molding Machine with Sidelights on Latter-Day Practice," by J. J. Wilson, Cadillac Motor Car Co., Detroit, and A. O. Backert, The Foundry, Cleveland.

"Scientific Management and Its Relation to the Foundry Industry," by H. K. Hathaway, Tabor Mfg. Co., Philadelphia.

"Reclaiming Molding Sand," by W. M. Saunders and H. B. Hanley, Saunders & Franklin, analytical and consulting chemists, Providence, R. I.

"The Relation of the Foundry Foreman to His Employer," by S. V. Blair, Rushville, Ind.

TUESDAY, SEPT. 28, 8 p.m.

Theatre party for members and ladies of the American Foundrymen's Association and the American Institute of Metals.

WEDNESDAY, SEPT. 29, 10 a.m. CONVENTION HALL

"The Modern Foundry Advance," by Dr. Richard Moldenke, consulting metallurgical engineer, Watchung, N.J.

"Manufacture, Constituents and Essentials in the Purchase of Pig Iron for Foundry Use," by Oliver J. Abell, The Iron Age, Chicago.

Report of the A. F. A. committee on costs, by B. D. Fuller, chairman, Westinghouse Electric & Mfg. Co., Cleveland.

Organization in the Foundry of the University of Illinois Shop Laboratories," by R. E. Kennedy and J. H. Hogue, instructors, University of Illinois, Urbana, Ill.

"The Structural or Mechanical Theory of the Effect of Rust on Cast Iron and Wrought Iron or Steel," by R. C. McWane, publisher

THURSDAY, SEPT. 30, 10 a.m. AND 2.30 p.m. CONVENTION HALL AND ANNEX

Steel Sessions

"Dynamic Properties of Steel Employed in the Manufacture of Castings of Various Types," by J. Lloyd Uhler, Union Steel Casting Co., Pittsburgh.

"The Particular Application of the Converter in the Manufacture of Steel Castings," by C. S. Koch, Fort Pitt Steel Casting Co., McKees-port, Pa.

"Notes on Electric Furnace Construction and Operation in the Steel Foundry," by James H. Gray, U. S. Steel Corporation, New York City.

"Open-Hearth Furnace Checker Design," by W. A. Janssen, Bettedorf Co., Davenport, Iowa.

"Causes of Shrinkage Cracks in Steel Castings," by William R. Bossinger, Marion Steam Shovel Co., Marion, O.

Report of A. F. A. committee on specifications for steel castings, by W. C. Hamilton, American Steel Foundries, Granite City, Ill.

Report of A. F. A. committee on steel foundry standards, by Dudley Shoemaker, American Steel Foundries, Indiana Harbor, Ind., and R. A. Bull, Commonwealth Steel Co., Granite City, Ill.

"Notes on Arc Welding," by Robert Kinkead, Lincoln Electric Co., Cleveland.

Malleable Sessions

"Some Remarks Regarding the Permissible Phosphorus Limit in Malleable Iron Castings," by Prof. Enrique Touceda, Rensselaer Polytechnic Institute, Albany, N.Y.

"Standardization of Air Furnace Practice," by A. L. Pollard, Johnston Harvester Co., Batavia, N.Y.

"An Outline to Illustrate the Interdependent Relationship of the Variable Factors in Malleable Iron Practice," by L. E. Gilmore, Baltimore Malleable & Steel Co., Baltimore.

Paper on malleable practice, by J. P. Pero and J. C. Nulsen, Missouri Malleable Iron Co., East St. Louis, Ill.

"Coal—Its Origin and Use in the Air Furnace," by F. Van O'Linda, Consolidation Coal Co., Chicago.

THURSDAY, SEPT. 30, 7 p.m., HOTEL TRAYMORE

Annual banquet.

FRIDAY, OCT. 1, 10 a.m. CONVENTION HALL

Introduction of new officers.
Report of committee on resolutions.
Appointment of standing committees.
Unfinished business.

American Institute of Metals

TUESDAY, SEPT. 28, 10 a.m. CONVENTION HALL

Joint meeting with the American Foundrymen's Association. (For details see A. F. A program.)

TUESDAY, SEPT. 28, 2 p.m. HOTEL TRAYMORE

General Papers

Report of official chemist, by Arthur D. Little, Inc., Boston.

"An Investigation of Fusible Tin Boiler Plugs," by Dr. G. K. Burgess, Bureau of Standards, Washington, D.C.

"The Influence of the Impurities of Spelter on the Cracking of Slush Castings," by Gilbert Rigg, New Jersey Zinc Co., Newark, N.J.

"Cobalt in Non-Ferrous Metals," by H. T. Kalmus, Kalmus, Comstock & Westcott, Cambridge, Mass.

"Furnace Methods for Pure Castings," by F. L. Antisell, Raritan Copper Works, Perth Amboy, N.J.

"Standard Test Specimen of Zinc-Bronze: Cu. 88, Sn. 10, Zn. 2. Relation of the Mechanical Properties to the Microstructure," by Dr. H. S. Rawdon, Bureau of Standards, Washington, D.C.

"Notes on the Copper-Rich Kalchoids," by S. L. Hoyt, University of Minnesota, Minneapolis.

TUESDAY, SEPT. 28, 8 p.m.

Theatre party.

WEDNESDAY, SEPT. 29, 10 a.m. HOTEL TRAYMORE

"The Effect of the Present European War on the Metal Industries," by Thos. F. Wettstein, United Lead Co., New York.

"Sherardizing," by Dr. S. Trood, U. S. Sherardizing Co., New Castle, Pa.

"Electric Furnace for Brass Melting," by F. A. S. Fitzgerald, Fitzgerald Laboratories, Niagara Falls, N.Y.

"Substitutes and Alloys to Take the Place of Platinum," by, W. E. Mowrey, St. Paul, Minn.

"Alloys of Nickel, Chromium and Copper," by David F. McFarland and O. E. Harder, University of Illinois, Urbana, Ill.

WEDNESDAY, SEPT. 29, 2 p.m. HOTEL TRAYMORE

Aluminum and Aluminum Alloys

"Aluminum Die Castings," by Chas. Pack, Doehler Die Casting Co., Brooklyn, N.Y.

"The Manufacture and Use of Alumino-Vanadium," by Wm. W. Clark Seymour Mfg. Co., Seymour, Conn.

"Recent Advances in the Manufacture and Uses of Aluminum," by E. V. Pannell, British Aluminum Co., Toronto, Ont.

"The Welding of Aluminum," by E. V. Pannell, British Aluminum Co., Toronto, Ont.

"Aluminum Bronze Alloys," by W. M. Corse, Titanium Alloy Mfg. Co., Niagara Falls, N.Y.

THURSDAY, SEPT. 30, 10 a.m. HOTEL TRAYMORE

Acid Metals and Bearing Bronzes

"Development of an Acid-Resisting Alloy," by S. W. Parr, University of Illinois, Urbana, Ill.

"Methods of Analysis for Complex Alloys," by S. W. Parr, University of Illinois, Urbana, Ill.

"Effect of Zinc on Copper, Tin, Lead Alloys," by G. H. Clamer, Ajax Metal Co., Philadelphia.

"The Advantages of a Standard Railway Journal," by Russell R. Clark, Pennsylvania Railroad, Pittsburgh.

THURSDAY, SEPT. 30, 2 p.m. HOTEL TRAYMORE

Forging and Rolling Alloys

"Forging Manganese Bronze," by Jesse L. Jones, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

"The Failure of Structural Bronzes," by Dr. P. D. Merica, Bureau of Standards, Washington, D.C.

"Experiences with Brass in Civil Engineering Work," by A. D. Flinn, board of water supply, New York.

"Stellite," by Elwood Haynes, Haynes Stellite Works, Kokomo, Ind.

THURSDAY, SEPT. 30, 7 p.m. HOTEL TRAYMORE

Annual banquet.

Plant Visitation

A large number of important foundries have agreed to throw open their doors to the visitors. Among those may be mentioned the following:—

Southwark Foundry & Machine Co., Philadelphia.

American Engineering Co., Philadelphia.

Girard Iron Works, Philadelphia.

Sheeler-Hemsher Co., Philadelphia.

Eynon-Evans Mfg. Co., Philadelphia.

Baldwin Locomotive Works, Philadelphia.

J. W. Paxson Co., Philadelphia.

Tabor Mfg. Co., Philadelphia.

Isaac A. Shepherd & Co., Philadelphia.

R. D. Wood & Co., Philadelphia.

Wm. Sellers & Co., Inc., Philadelphia.

Ajax Metal Co., Philadelphia.

Thomas Devlin Mfg. Co., Philadelphia.

Niles-Bement-Pond Co., Philadelphia.

American Steel Foundries, Chester, Pa.

Seaboard Steel Casting Co., Chester, Pa.

Worth Bros. Co., Coatesville, Pa.

Baldt Steel Co., New Castle, Del.

The committee in charge of plant visitation is as follows:—

H. W. Brown, chairman, Tabor Mfg. Co., Philadelphia; Harry E. Asbury, Enterprise Mfg. Co., Philadelphia; W. J. Coane, Ajax Metal Co., Philadelphia; Geo. C. Davies, Pilling & Crane Co., Philadelphia; Harry Drinkhouse, Thos. Devlin Mfg. Co., Philadelphia; Thomas Evans, Eynon-Evans Mfg. Co., Philadelphia; Chas. H. Harrar, Midvale Steel Co., Philadelphia; J. S. Hibbs, J. W. Paxson Co., Philadelphia; Wilfred Lewis, Tabor Mfg. Co., Philadelphia; Geo. F. Pettinos, Pettinos Bros., Bethlehem, Pa.; Wm. H. Ridgway, Craig Ridgway & Son Co., Coatesville, Pa.; F. L. Shepherd, I. A. Shepherd Co., Philadelphia; A. G. Warren, J. W. Paxson Co., Philadelphia; and Robert Wetherill, Jr., Robert Wetherill & Co., Chester, Pa.

For the Devotees of Golf

To afford the visiting foundrymen an opportunity to indulge in the favorite pastime of golf, special arrangements have been made with the Country Club of Atlantic City for the use of its course at Northfield, N.J. This feature is in charge of a special committee, whose members will afford the golf devotees every assistance to indulge in this favorite sport. The committee is constituted as follows:—H. M. Bougher, chairman, J. W. Paxson Co., Philadelphia; Peter S. Brauscher, Philadelphia & Reading Railroad, Reading, Pa.; W. J. Coane, Ajax Metal Co., Philadelphia; Wm. J. Devlin, Thomas Devlin Mfg. Co., Philadelphia; Howard Evans, J. W. Paxson Co., Philadelphia; Howard C. Matlack, Marshall, Matlack Co., Philadelphia; H. P. Rebman, American Engineering Co., Philadelphia; Otto Schaum, Schaum & Uhlinger Co., Philadelphia; J. H. Sheeler, Sheeler, Hemsher Co., Philadelphia; W. P. Smith, Wm. Cramp Ship & Engine Building Co., Philadelphia; and E. P. Williams, Baldwin Locomotive Works, Philadelphia.

Local Convention Committee

The local convention committee includes the following:—

Thomas Devlin, chairman, president Thomas Devlin Mfg. Co., Philadelphia; W. H. Bassett, vice-president American Institute of Metals, American Brass Co., Waterbury, Conn.; Henry A. Carpenter, vice-president American Foundrymen's Association, General Fire Extinguisher Co., Providence, R.I.; A. F. Corbin, president New England Foundrymen's Association, Union Mfg. Co., New Britain, Conn.; Alex. T. Drysdale, vice-president American Foundrymen's Association, United States Cast Iron Pipe & Foundry Co., Burlington, N.J.; Stanley G. Flagg, Jr., past president American Foundrymen's Association, Stanley G. Flagg & Co., Philadelphia; H. W. Gillett, vice-president American Institute of Metals, Ithaca, N.Y.; Dr. Richard Moldenke, past secretary, American Foundrymen's Association, Watchung, N.J.; Geo. C. Stone, vice-president American Institute of Metals, New Jersey Zinc Co., New York; A. W. Walker, past president, American Foundrymen's Association, Walker & Pratt Mfg. Co., Boston, and Walter Wood, vice-president American Foundrymen's Association, R. D. Wood & Co., Philadelphia.

List of Exhibitors.

Ajax Metal Co., Philadelphia, Pa.
Arcade Mfg. Co., Freeport, Ill.
E. C. Atkins & Co., Indianapolis, Ind.
Ayer & Lord Tie Co., Chicago.
Berkshire Mfg. Co., Cleveland, O.
Chas. H. Besly & Co., Chicago.
S. Birkenstein & Sons, Chicago.
Blystone Mfg. Co., Cambridge Springs, Pa.
Brass World and Plater's Guide, New York City.
Brown Specialty Machinery Co., Chicago.
Buch Foundry Equipment Co., Bridgeport, Pa.
Buckeye Products Co., Cincinnati, O.
Carborundum Co., Niagara Falls, N.Y.
Cataract Refining & Mfg. Co., Buffalo, N.Y.
Charles J. Clark, Chicago.
Clark Foundry Co., Rumford, Me.
Clearfield Machine Shops, Clearfield, Pa.
Cleveland Automatic Machine Co., Cleveland, O.
Cleveland Pneumatic Tool Co., Cleveland, O.
Clipper Belt Lacer Co., Grand Rapids, Mich.
Geo. P. Clark Co., Windsor Locks, Conn.
Joseph Dixon Crucible Co., Jersey City, N.J.
Electric Controller & Mfg. Co., New York.
Felt & Tarrant Mfg. Co., Chicago.
Factory (A. W. Shaw Publishing Co.), Chicago.
Gardner Machine Co., Beloit, Wis.
General Electric Co., Schenectady, N.Y.
Goldschmidt Thermit Co., New York.
Graceton Coke Co., Graceton, Pa.
Great Western Mfg. Co., Leavenworth, Kansas.
F. A. Hardy & Co, New York.
Hayward Co., New York.
Herman Pneumatic Machine Co., Zelienople, Pa.
The Herold Bros. Co., Cleveland, O.
Hill & Griffith Co., Cincinnati, O.
Hunter Saw & Machine Co., Pittsburgh, Pa.
Ingersoll-Rand Co., New York.
International Molding Machine Co., Chicago.
International Steam Pump Co., New York.
The Iron Age, New York.
Iron Tradesman, Atlanta, Ga.
Jennison-Wright Co., Toledo, O.
Julius King Optical Co., Chicago.
Landis Tool Co., Waynesboro, Pa.
Lehigh Coke Co., South Bethlehem, Pa.
Lincoln Electric Co., Cleveland, O.
David Lupton's Sons Co., Philadelphia, Pa.
J. S. McCormick Co., Pittsburgh, Pa.
McCrosky-Reamer Co., Meadville, Pa.
MacLean Publishing Co., Toronto, Ont.
The Macleod Co., Cincinnati, O.
Mahr Mfg. Co., Minneapolis, Minn.
Malleable Iron Fittings Co., Branford, Conn.
Midland Machine Co., Detroit, Mich.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Mott Sand Blast Mfg. Co., Chicago.
E. H. Mumford Co., Elizabeth, N.J.
Mumford Molding Machine Co., Chicago.
Metal Record and Electro-Plater, Bridgeport, Conn.
National Engineering Co., Chicago.
New Haven Sand Blast Co., New Haven, Conn.
The Norma Company of America, New York.
Norton Co., Worcester, Mass.
S. Obermayer Co., Chicago.
Osborn Mfg. Co., Cleveland, O.
Oxweld Acetylene Co., Chicago.
Pangborn Corporation, Hagerstown, Md.
J. W. Paxson Co., Philadelphia, Pa.
Penton Publishing Co., Cleveland, Ohio.
Pickands, Brown & Co., Chicago.
Henry E. Pridmore, Chicago.
Philadelphia Bourse, Exhibition Dept., Philadelphia, Pa.
Railway Age Gazette, Chicago.
Ready Tool Co., Bridgeport, Conn.
Richey, Brown & Donald, Inc., New York.
Robeson Process Co., New York.
Rogers, Brown & Co., Cincinnati, O.
Sand Mixing Machine Co., New York.
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.
W. W. Sly Mfg. Co., Cleveland, Ohio.
R. P. Smith & Sons, Chicago.
Snyder Electric Furnace Co., Chicago.
Standard Sand & Machine Co., Cleveland, O.
Sterling Wheelbarrow Co., West Allis, Wis.
W. F. Stodder, Syracuse, N.Y.
Strong, Kennard & Nutt Co., Cleveland, O.
Sullivan Machinery Co., Chicago.
Tabor Mfg. Co., Philadelphia, Pa.
Thomas Iron Co., Easton, Pa.
Titanium Alloy Mfg. Co., Niagara Falls, N.Y.
Union Steam Pump Co., Battle Creek, Mich.
U. S. Graphite Co., Saginaw, Mich.
Waterbury Welding Co., Waterbury, Conn.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Whlie & Bro., Inc., Philadelphia, Pa.
Whiting Foundry Equipment Co., Harvey, Ill.
T. A. Willson Co., Reading, Pa.
E. J. Woodison Co., Detroit, Mich.
T. B. Wood's, Sons Co., Chambersburg, Pa
Wyoming Shovel Works, Wyoming, Pa.

Steel Ingots for Guns.—Prof. J. O. Arnold, of Sheffield University, at the Royal Institution, said that the managing director of Krupps told him that they were making steel ingots weighing 110 tons for guns by the crucible process evolved 175 years ago by an Englishman—Benjamin Huntsman. Neither the Germans nor the Americans could produce the Sheffield white crucible, however. That was a secret handed down from father to son in Sheffield. In the North of England they were making ingots weighing 150 tons, and there were 12,000-ton presses squeezing out armor plate like cheese.

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Machine, Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

HIGH SPEED HACK SAW MACHINE

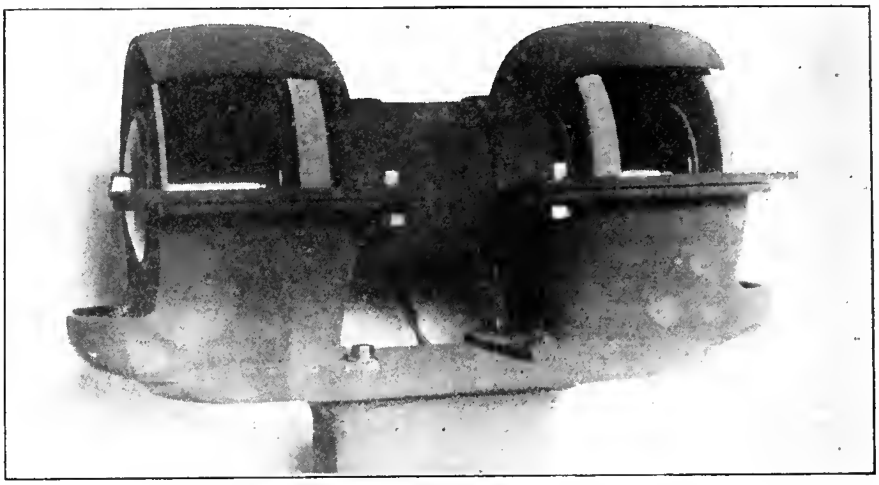
THERE has recently been put upon the market the high speed hack saw machine here described and illustrated. It has been developed by the Massachusetts Saw Works, Springfield, Mass., and embodies among other features a shock absorber, extension frame, swivel-jaw vise, and an automatic patent lift.

The machine is particularly designed for the rapid cutting of metals in sizes up to 9 by 9 inches, and is heavily constructed with all intricate mechanism eliminated as far as possible. The unit is set low on a solid foundation with wide-spread legs to give the maximum rigidity and steadiness, while a large pan for suds surrounds the bed and contains a 9-gal. tank divided and screened for chips. The tank, pan, bed and legs together form a single casting. The power section or head of the machine swings on a shaft centre, an arrangement which is relied upon to give a steady, silent motion with little wear and to secure a full length stroke of the blade at any angle. The bearings have, as far as possible, been made heavy and wide throughout the machine, and readily accessible arrangements for taking up the wear are provided.

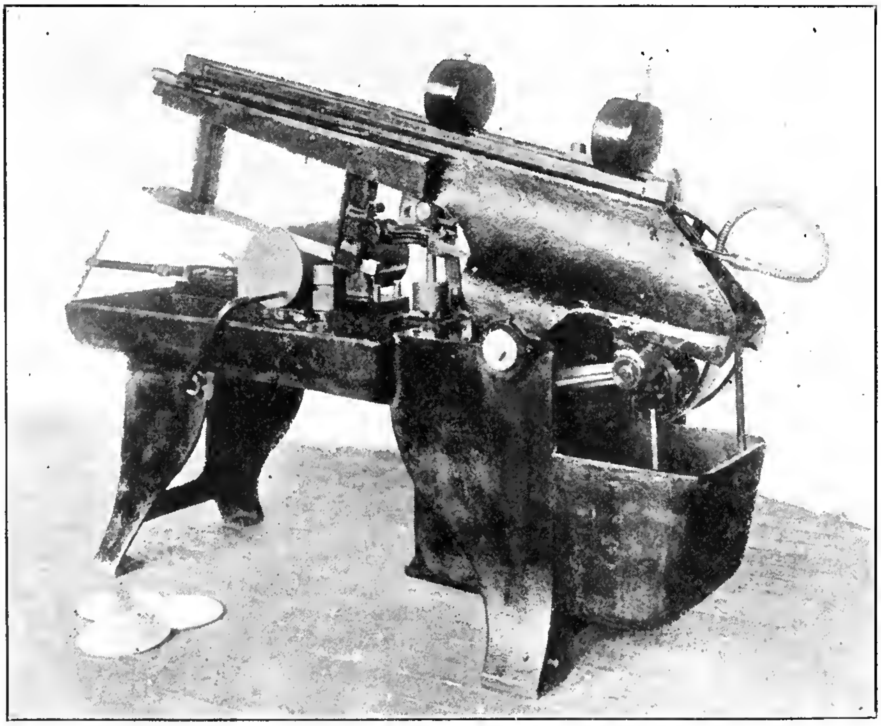
Two speeds for the saw blade are provided, the change being made by shifting the starting lever on the back of the machine to engage one or the other of the pulleys mounted on the driving shaft.

The descent of the blade is lever controlled and cushioned, while the vertical movement may be stopped at any point, a shock absorbing device permitting it to engage the material gently. On completion of the cut the machine stops, an oil dashpot under the bed acting as a cushion.

The extension frame will hold blades ranging from 12 to 17 in. in length. To vary the length of the frame, it is simply necessary to push a button which releases the locking mechanism, and pull the frame out as far as desired, after which the blade is inserted without other manipulation. Means are provided for lifting the saw clear of the work on the idle or non-cutting stroke.



SPECIAL PATTERN SHOP GRINDING MACHINE.



HIGH SPEED HACK SAW MACHINE.

The patent swivel-jaw vise has a capacity of 9 in. and the rear jaw may be set at any angle up to 45 deg. in either direction. The front or sliding jaw will adjust itself to the angle of the fixed jaw or to an irregular surface. If desired, the vise may be advanced along the table of the machine to double the capacity of the blades on small work or it can be removed entirely and bolts and clamps substituted when necessary.

A rotary pump with a double check valve delivers cutting compound to the blade as soon as the machine starts. The lubricating system has received particular attention and includes oil cups, waste boxes and holes for every bearing or working point.

The principal dimensions of the machine are as follows: Capacity for cutting stock up to 9 inches square; size of blades, from 12 to 17 inches in length; size of pulleys, 16 inches in diameter by 3 inches face width; floor space occupied, 5 feet 3 inches by 2 feet 8 inches; and weight of machine 845 pounds.

PATTERN SHOP GRINDING MACHINE.

THIS new tool grinder, which is a product of the Forbes & Myers Co., Worcester, Mass., has been designed to meet the needs of pattern-making and other

wood-working shops. It is made in both the bench and floor types, the photograph showing the grinder and top of stand of the floor type machine.

The regular equipment of wheels consists of one 10 in. x 1 in. with flat face for grinding chisels and other straight edge tools, also three round face wheels 10 in. in diameter by 1 in., ½ in., and ¼ in. respectively in thickness, for grinding gouges and special cutters. Other shapes of wheels can also be furnished.

The spindles are ¾ in. in diameter and ample space is allowed between the wheels. The guards are of heavy malleable iron, and the tool rests are adjustable in two directions. High grade ball bearings are used, these being thoroughly protected from dirt and grit by double grooved covers, and packed in grease.

The motor is of the squirrel cage induction type and can be supplied for two or three-phase alternating current circuits only. The capacity of the motor which is fully inclosed as a protection against dirt and mechanical injury, is ½ h.p. Frequencies of 25, 50 or 60 cycles can be used, the speed being 1,500 r.p.m. on the 25 and 50-cycle circuits, and 1,800 r.p.m. with the 60-cycle current.

MACHINE FOR SPRAYING SHRAPNEL SHELLS

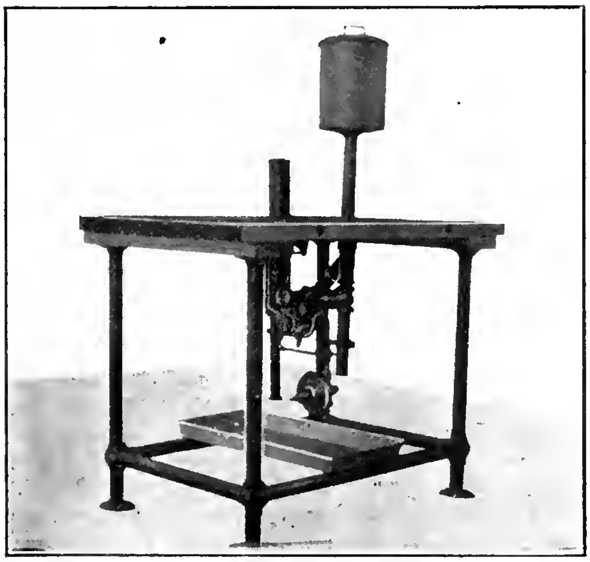
TO coat the inside of shells, or for that matter any relatively inaccessible surface, with an asphaltum paint or anti-corrosion material, and to do the work rapidly, uniformly, and without waste of the coating compound, the Spray Engineering Co., Boston, Mass., has developed an interesting machine.

It looks not unlike a strongly built table with a circular recess in the top. The operator inverts a shell over the recess, pushes it down an inch or so into the latter, lifts it from the table, and the operation is completed, the shell having received its coating. He is then ready to repeat the operation with another shell. As the period covered in thus spraying a shell is 2 sec., or at the rate of 30 per minute, the capacity of the machine for coating is placed at 1,500 per hour.

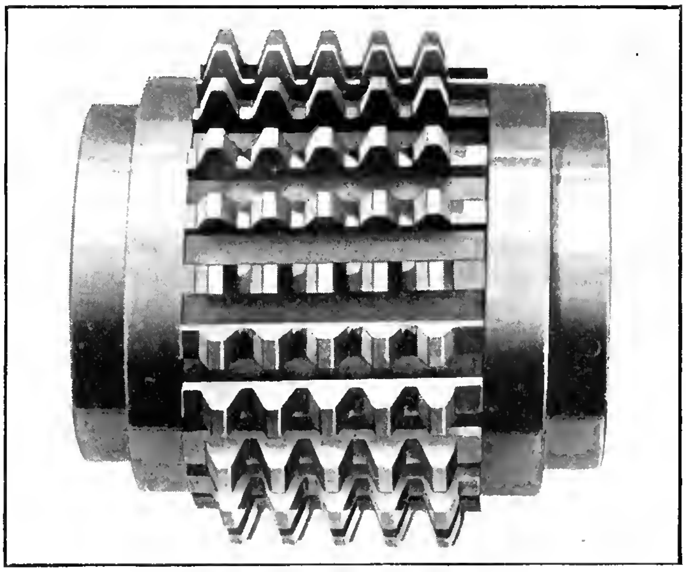
The act of pushing the shell downward admits a supply of compressed air to a definite quantity of the protective liquid, which is driven through a spraying nozzle. The apparatus is supported under the table top. It includes what is substantially a three-way valve which holds the protective liquid and which opens the channel between the compressed air supply and the nozzle when the shell is down, so to speak, and which receives the measured amount of liquid for the next shell when the pressure of the operator's hand is removed: that is, when the coated shell is removed. The fact that only the desired amount of liquid is admitted each time is a particular feature and application has been made for a patent covering the device. The working parts are counterbalanced as far as possible so that a minimum pressure will suffice to push the shell to the spraying position. It is obvious the machine is likely to find fields of usefulness outside of that for which it has been brought into being.

The height of the spray head is adjusted to coat the entire inner surface of the shell and the extent of this surface with the prescribed thickness of the paint film, sometimes 0.00025 in., gives some measure of the requirements. The amount of paint is regulated by what corresponds to a plunger which may be screwed in or out, decreasing or increasing the contents of the measuring chamber. For a given size of shell and a given paint and thickness of film, it is found that one setting of the measuring device suffices to insure that not only is sufficient paint sprayed upon the shell surface but there is no excess which has to be disposed of. The machine thus aims at a maximum economy of the protecting compound beside allowing for high working speed.

It is expected that the fundamental elements of the machine, the use of the spray head, and of the scheme for automatically measuring out the quantity of material to be sprayed, may have applications apart from war munitions. However, at this writing the company is engaged on working out details for utilizing the machine for spraying the small annular passage in the timing device or nose portion of the shell. This passage, which receives the time fuse, is small and somewhat inaccessible, and to swab the passage with a hand brush consumes too much time in view of the demands for high quantity production. It appears that in spite of the fact that the timing parts of the shell are of brass, the powder has a corroding influence, which fact makes it desirable to poteet the brass work.



SHRAPNEL SHELL SPRAYING APPARATUS.



LEES-BRADNER HYPERBOLOID HOB.

HOB OR GENERATING TOOL

THE accompanying illustration shows the type of generating tool, commonly called a hob, as produced by the Lees-Bradner Co., Cleveland, Ohio.

Technical papers for years past have been full of arguments pro and con on the hobbing process, or as it should be correctly termed, the generating process. Much of the criticism, justly made, as far as practice was concerned, was due both to practice and theory—the errors being occasioned almost universally by

error in the hob, or due to the design of the machine employed.

The cardinal principles of gear cutting cannot be overlooked simply because the gears are hobbed. In other words, gears must be concentric, and the sides of the teeth must be uniform. These two features have been most criticized from the fact that the teeth have not been uniform due to the hob, or the gears have not been concentric, due to the design of the tool on which the hob was used.

The Lees-Bradner Co., who are pioneers in the art of hobbing gears, have made a careful study of this subject for a number of years, as a result of which the "hyperboloid" hob shown in the illustration has been developed. The theoretical considerations calling for the use of a hob of this form are that the cutting edges of each series of teeth must enter and depart simultaneously on a theoretical line, which has been designated the "generating plane."

It will be apparent in a hob of the solid cylindrical type, which is fluted at right angles to the lead, that the row of teeth which is generating presents an elliptical outline to the gear being cut. In addition, the helical flute presents a warped surface with one end of the flute stubbed and the other end raked, as far as the generating plane is concerned. This can be readily seen if the fact is grasped that a section taken through a cylinder at right angles to the axis is a circle, that a section taken through a cylinder parallel to the axis is a rectangle, while a section taken through a cylinder at an angle to the axis is an ellipse.

As a result, it will be evident that with the hob set at its working angle, an elliptical outline will be presented to the work. Therefore, to obtain a hob that will produce a rectangle under these conditions, it is necessary for the tool to be of hyperboloid outline. The hyperboloid hob shown is made up of a series of high-speed steel racks which are ground for lead, side relief, top relief, and to provide sharp cutting edges. The racks can be renewed as they become worn out, and as the housing is hardened and the bore ground to a plug gauge fit, it is likely to last indefinitely.

TO DEVELOP MUNITIONS OUTPUT IN CANADA

STEPS were taken by the Canadian Government on Sept. 13 to organize an effective and energetic coalition of the representatives of industry and finance with the Militia Department towards the production in Canadian factories of war munitions in the largest possible quantities and with the greatest possible expedition.

Representatives of finance and industry to the number of a hundred or more were summoned to Ottawa by Sir Robert Borden and Sir Sam Hughes for a conference as to how best to finance and produce the ammunition, ordnance and supplies of all kinds of war munitions which Canada can furnish to meet the pressing needs of Great Britain and her allies.

Devising Ways and Means

To-day's conference was with a view to taking counsel together as to the possibilities of manufacture, the methods of financing, etc. The conference was, of course, of a confidential character, but the discussion emphasized the fact that through adequate co-operation and organization Canada can and will do much more towards meeting the most urgent needs of the allies at the present time—namely, the furnishing of the engines of war, including the manufacture of field guns.

Permanent Advisory Board

A sub-committee of those attending the conference was appointed, under the chairmanship of Sir John Gibson, and this committee met for three hours and carefully considered the whole situation. As a result a report will be presented a little later to the Minister of Militia, embodying some suggestions as to organization and methods of distributing and filling orders, and in regard to proposals for the manufacture of ordnance of various kinds. The sub-committee adjourned, to meet at the call of the chairman, and it will constitute a permanent advisory body to the Government.

The conference, which was held in the room of the Militia Council, was presided over by Sir Sam Hughes, who gave to those present a full and frank statement of the needs and opportunities of the situation.

Sir Robert Borden also spoke at some length, giving the conclusions reached from his conferences with the War Office and Munitions Department in London.

Personnel of Conference

The personnel of the conference included the following: Hon. Major-General Sir Sam Hughes, President; Sir Robert Borden, Brig.-Gen. Bertram, Sir John Gibson, J. F. Taylor and Arch. Stewart, Algoma Steel Company, Sault Ste. Marie; Col. Noel Marshall; John Carew, M.P.P., Lindsay; Col. Woods, Ottawa; Col. Wanklyn, C.P.R., Montreal; James Young of the John Bertram & Sons' Co.; P. L. Findlay, Montreal; H. Bertram, Dundas; H. M. Asling, Polson Iron Works, Toronto; M. C. Ellis, Toronto; R. Gilmour, Ottawa; W. R. Angus, Canada Star Foundry, Montreal; H. D. Pickett, Moose Jaw; G. H. Duggan, Dominion Bridge Co., Montreal; G. H. Chaplin, St. Catharines; Brig.-Gen. F. S. Meighen, Montreal; Col. C. W. Watts, Canadian General Electric Co.; Major R. W. Leonard, F. P. Jones, Sir. W. Mackenzie, Edward Gurney, Toronto; S. Major, Hamilton; H. H. Vaughan, Montreal Ammunition Co., Montreal; E. Hay, General Manager Imperial Bank of Canada, Toronto; B. B. Stevenson, Quebec Bank, Montreal; Sir William Ince, Union Bank, Quebec; G. H. Balfour, General Manager Union Bank of Canada, Winnipeg; C. P. Schofield, General Manager Standard Bank of Canada, Toronto; F. L. Pease, General Manager, Royal Bank of Canada, Montreal; Sir Herbert Holt, President Royal Bank of Canada, Montreal; Sir Edmund Walker, President Canadian Bank of Commerce, Toronto; John Aird, General Manager Canadian Bank of Commerce, Toronto; H. A. Richardson, General Manager Bank of Nova Scotia, Toronto; K. W. Blackwell, Vice-President Merchants Bank of Canada, Montreal; Hector McInnes, K.C., Halifax, N.S.; Sir Lyman M. Jones, Toronto; Senator Edwards, Ottawa; H. W. Wheatley, Can. Loco. Works, Kingston; W. D. Robb, G. T. R., Montreal; T. J. Dillon, Welland; A. R. Goldie, Galt; J. P. McNaughton, Sydney; W. Inglis, Toronto; Rev. F. W. Squire, Ottawa; D. Lemon, Montreal; J. A. Vaillancourt, Montreal; John P. Dunn, Prescott Emery Wheel Co., Prescott; Sir Henry M. Pellatt, Toronto; P. C. Brooks, Can. Fairbanks-Morse Co., Toronto; C. G. Drinkwater, Can. Fairbanks-Morse Co., Montreal; E. W. Gilman, Ingersoll Rand Co., Sherbrooke; E. S. Winstow; Col. Fred Nicholls, Toronto; M. L. Davis, Standard Chemical Co., Toronto; Douglas C. Ridout, President Toronto Furniture Co., Toronto; Robert Hobson, Steel Company of Canada, Hamilton; George Burn, President Canadian Bankers' Association; A. D. Braithwaite, Bank of Montreal; E. F. Hebden, Merchants Bank, Montreal; H. B. Mackenzie, Bank of British North America, Montreal; H. J. Myler, Hamilton; Warren Y. Soper, Ottawa Car Works.

Sub-Committee on Ordnance

The sub-committee appointed to report on an increase in munitions, and particularly to inquire into the feasibility of Canada, in addition to making shells, going into the manufacture of heavy guns and ordnance, is as follows:

Sir John Gibson, the members of the Shell Committee, Col. Nicholls, Toronto; W. D. Robb of the Grand Trunk; Hector McInnes, Halifax; F. L. Wanklyn, C. P. R.; Sir Lyman Jones, Sir William Mackenzie, Toronto; Senator Edwards, Ottawa; K. W. Blackwell, Montreal; James Young, Dundas; G. H. Duggan, Montreal; George Burn, Ottawa; J. Chaplin, St. Catharines, and P. L. Miller of the Canadian Vickers Co.

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THE FUTURE OF DEMOCRATIC LABOR

When Bellamy wrote that noteworthy book, "Looking Backward," he did not enter into specific details regarding previous conditions, the climax of which was characterized as a world cataclysm. Social developments in Britain previous to this war were proceeding at a rapid pace to a point where opposition of a decided nature was beginning to show itself. A complete permeation of society with democratic ideas, such as are evidenced by state insurance and employment bureaus might probably have resulted in that social upheaval or disruption in the mysteries of which Bellamy shrouded his imaginary transformation of human society. The scheme by which each member of society was allowed to pursue the active duties which were most congenial to the individual and of corresponding value to the community, in return for which he was entitled to a sufficiency of life's necessities and luxuries, has had, and always will have a great attraction for those whose effort is to secure for labor an adequate reward.

Attempts have been made on different occasions to put into practice some of the basic principles of socialism. Some have succeeded and some have failed; the failures being partly due to the fact that man is occasionally possessed of ambition, and the "bacillus ambitionis" has decided objection to being levelled down or otherwise restrained from exerting its expansive properties.

Students of current events may perhaps perceive in the present turmoil of affairs, a change in man's attitude to man, the ultimate result of which will be a considerable advance toward that Utopian existence so ardently advocated in some quarters. Germany, as a nation, seems to have had some idea of developing the world on Bellamistic lines, but made the unfortunate mistake of trying to force matters. Her loss will, however, prove to be the world's gain first, and her own gain ultimately.

The great change in society's attitude toward labor is at the present time more strongly evidenced in Europe than in Canada. This is so because of the more acute conditions prevailing there.

Its most important feature is, perhaps, the acknowledgement by society of its absolute dependence on labor, and by society is meant the nation, government, titled and untitled persons, the rich and the poor. When lords and similarly classed individuals get into overalls and do their bit voluntarily because they realize the necessity, it ill befits labor to counteract these additional efforts by wilful abstinence from production.

Canadian labor has shown and will continue to show a patriotic enthusiasm in production, which one would fain believe to be universal in the Motherland. Canadian manufacturers have shown an appreciation of labor's efforts, such as never would have occurred in times of peace, and the chief interest of labor should now be how to maintain that appreciation when peace returns.

It is quite obvious that if the majority of men receive adequate remuneration, they will give adequate service, willingly and continuously, always provided, of course, that not more than adequate profit is acquired through their labor. The experience of the British Government in organizing controlled shops may ultimately be incorporated in legislative efforts which may be epoch-marking, and the indiscriminate mixing of all grades of society which has taken place with the growth of Britain's armies will have an undoubted influence on the future reception of democratic legislation.

While Canada as a younger and distant nation has had to form her national character alone and unaided, the centuries old experience of the Motherland has always been available, and in the readjustment of affairs in the days yet to come, the development of advanced democratic views in all branches of Canadian life, will be not the least interesting result of that spirit of co-operation now so happily existing between employees and employers.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey forge, Pittsburgh	$14 70
Lake Superior, charcoal, Chicago	15 75
Ferro Nickel pig iron (Soo)	25 00

	Montreal.	Toronto.
Middlesboro, No. 3	22 00	.....
Carron, special	23 00	.....
Carron, soft	23 00	.....
Cleveland, No. 3	22 00	.....
Clarence, No. 3	22 50	.....
Glengarnock	26 00	.....
Summerlee, No. 1	28 00	.....
Summerlee, No. 3	27 00	.....
Michigan charcoal iron.	26 00	.....
Victoria, No. 1	23 00	19 00
Victoria, No. 2X	22 00	19 00
Victoria, No. 2 plain..	22 00	19 00
Hamilton, No. 1	22 00	19 00
Hamilton, No. 2	22 00	19 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	2.20
Steel bars, f.o.b., Toronto	2.20
Common bar iron, f.o.b., Montreal	2.20
Steel bars, f.o.b., Montreal	2.20
Twisted reinforcing bars	2.20
Bessemer rails, heavy, at mill....	1.25
Steel bars, Pittsburgh	1.30
Tank plates, Pittsburgh	1.30
Beams and angles, Pittsburgh....	1.30
Steel hoops, Pittsburgh	1.40
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.10
Small shapes	2.35
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.90
Structural shapes	1.95
Plates	1.95

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ¼ to ½ in., 100 lb.	$2 35	$2 25
Heads, per 100 lb.	2 55	2 45
Tank plates, 3-16 in.	2 60	2 45

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$12 25	$12 00
Copper, crucible	13 25	13 00
Copper, unch-bled, heavy	13 25	13 00
Copper, wire, unch-bled.	14 00	14 00
No. 1 machine compos'n	11 50	11 50
No. 1 compos'n turnings.	9 00	9 00
No. 1 wrought iron	6 50	6 50
Heavy melting steel	7 00	7 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings....	11 00	11 00
No. 1 brass turnings....	9 00	9 00
Heavy lead	5 00	5 00
Tea lead	$ 3 25	$ 3 50
Scrap zinc	8 50	9 00

W. I. PIPE DISCOUNTS.

Following are Toronto jobbers' discounts on pipe in effect Aug. 27, 1915:

	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
Standard				
¼, ⅜ in.	63	38½	....	....
½ in.	68	47½	....	....
¾ to 1½ in. ..	73	52½	....	....
2 in	73	52½	69	48½
2½ to 4 in ...	73	52½	72	51½
4½, 5, 6 in...	....	....	70	49½
7, 8, 10 in. ...	....	....	67	44½
X Strong P. E.				
¼, ⅜ in.	56	38½	....	....
½ in.	63	45½	....	....
¾ to 1½ in. ..	67	49½	....	....
2, 2½, 3 in. ..	68	50½	....	....
2 in.	....	....	63	45½
2½ to 4 in. ..	....	....	63	48½
4½, 5, 6 in. ..	....	....	66	48½
7, 8 in.	....	....	59	39½
XX Strong P. E.				
½ to 2 in.	44	26½	....	....
2½ to 6 in. ...	....	....	43	25½
7 to 8 in.	....	....	40	20½
Genuine Wrot Iron.				
⅜ in.	57	32½	....	....
½ in.	62	41½	....	....
¾ to 1½ in. ..	67	46½	....	....
2 in.	67	46½	63	42½
2½, 3 in.	67	46½	66	45½
3½, 4 in.	....	....	66	45½
4½, 5, 6 in. ..	....	....	63	42½
7, 8 in.	....	....	60	37½

Wrought Nipples.	
4 in. and under	77½%
4½ in. and larger	72½%
4 in. and under, running thread.	57½%
Standard Couplings.	
4 in. and under	60%
4½ in. and larger	40%

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws....	65%
Sq. Head Set Screws ....65 &	10%
Rd. & Fil. Head Cap Screws......	45%
Flat & But. Head Cap Screws....	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in. N.	70%
Semi-Fin. Nuts up to 1 in.	70%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

METALS.

	Montreal.	Toronto.
Lake copper, carload ...	$20 00	$19 00
Electrolytic copper	19 75	18 75
Castings, copper	19 00	18 50
Tin	39 00	39 00
Spelter	19 00	18 00
Lead	6 25	6 25
Antimony	40 00	38 00
Aluminum	40 00	38 00

Prices per 100 lbs.

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh...	$24 00
Openhearth billets, Pittsburgh..	24 50
Forging billets, Pittsburgh	32 00
Wire rods, Pittsburgh	29 00

NAILS AND SPIKES.

Standard steel wire nails, base	$2 40	$2 35
Cut nails	2 50	2 70
Miscellaneous wire nails..	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	75.
Stove bolts	80
Plate washers	40
Machine bolts, ⅜ and less......	70
Machine bolts, 7-16 and over....	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass.....35 p.c.	
Nuts, square, all sizes..4¼c per lb. off	
Nuts, Hexagon, all sizes.4¾c per lb. off	
Iron rivets .... 72½ per cent.	
Boiler rivets, base, ¾-in. and larger	$3.25
Structural rivets, as above.......	3.25
Wood screws, flathead, bright ....85, 10, 7½, 10 p.c. off	
Wood screws, flathead, Brass ....75 p.c. off	
Wood screws, flathead, Bronze ....70 p.c. off	

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong, Sizes Ins.	Price per ft.	D. Ex. Strong, Size Ins.	Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.....
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....

COKE AND COAL.

Solvay Foundry Coke	$5.75
Connellsville Foundry Coke	4.85-5.15
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

COLD DRAWN STEEL SHAFTING.

At mill	45%
At warehouse	40%

Discounts off new list. Warehouse price at Montreal and Toronto.

MISCELLANEOUS.

Solder, half-and-half	0.24
Putty, 100-lb. drums	2.70
Red dry lead, 100-lb. kegs, per cwt.	9.67
Glue, French medal, per lb.	0.18
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.18
Benzine, single bbls., per gal.	0.18
Pure turpentine, single bbls.	0.62
Linseed oil, raw, single bbls.	0.63
Linseed oil, boiled, single bbls.	0.66
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Lead wool, per lb.	0.10
Pure Manila rope	0.16
Transmission rope, Manila	0.20
Drilling cables, Manila	0.17
Lard oil, per gal.	0.73
Union thread cutting oil	0.60
Imperial quenching oil	0.35

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto 40%

PROOF COIL CHAIN.

1/4 inch	$8.00
5-16 inch	5.35
3/8 inch	4.60
7-16 inch	4.30
1/2 inch	4.05
9-16 inch	4.05
5/8 inch	3.90
3/4 inch	3.85
7/8 inch	3.65
1 inch	3.45

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	60
Carbon over 1½ in.	25
High Speed	40
Blacksmith	60
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Centre	25
Pipe Reamers	80

Discounts off standard list.

IRON PIPE FITTINGS.

Canadian malleable, A, 25 per cent.; B and C, 35 per cent.; cast iron, 60; standard bushings, 60 per cent.; headers, 60; flanged unions, 60; malleable bushings, 60; nipples, 75; malleable, lipped unions, 65.

TAPES.

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3.50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$3 00	$2 90
Canada plates, dull, 52 sheets	3 25	3 50
Canada Plates, all bright	4 40	4 60
Apollo brand, 10¾ oz. galvanized	6 40	5 95
Queen's Head, 28 B.W.G.	6 00	6 25
Fleur-de-Lis, 28 B. W. G.	5 75	5 75
Gorbal's Best, No. 28	6 50	6 50
Viking metal, No. 28	6 00	6 00
Colborne Crown, No. 28	5 38	5 30

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$11 00	....
1¼ in.	11 00	....
1½ in.	11 00	....
1¾ in.	11 00	....
2 in.	11 50	9 20
2¼ in.	13 00	....
2½ in.	14 00	12 10
3 in.	16 00	12 70
3¼ in.	....	13 90
3½ in.	20 00	15 00
4 in.	25 50	18 90

Prices per 100 feet, Montreal and Toronto.

WASTE.

WHITE.	Cents per lb.
XXX Extra	0 11
X Grand	0 10½
XLCR	0 09¾
X Empire	0 09
X Press	0 08¼
COLORED.	
Lion	0 07½
Standard	0 06¾
Popular	0 06
Keen	0 05½
WOOL PACKING.	
Arrow	0 16
Axle	0 11
Anvil	0 08
Anchor	0 07
WASHED WIPERS.	
Select White	0 08½
Mixed Colored	0 06¼
Dark Colored	0 05¼

This list subject to trade discount for quantity.

BELTING RUBBER.

Standard	50%
Best grades	30%

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50%
Standard	50 & 10%
Cut leather lacing, No. 1	$1.20
Leather in sides	1.10

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	$9.00
1/4 in.	6.25
5-16 in.	4.65
3/8 in.	4.00
7-16 in.	4.00
1/2 in.	4.00

Prices per 100 lbs.

PLATING CHEMICALS.

Acid, boracic	$ .15
Acid, hydrochloric	.05
Acid, hydrofluoric	.06
Acid, Nitric	.10
Acid, sulphuric	.05
Ammonia, aqua	.08
Ammonium carbonate	.15
Ammonium chloride	.11
Ammonium hydrosulphuret	.35
Ammonium sulphate	.07
Arsenic, white	.10
Copper sulphate	.10
Cobalt Sulphate	.50
Iron perchloride	.20
Lead acetate	.16
Nickel ammonium sulphate	.10
Nickel carbonate	.50
Nickel sulphate	.17
Potassium carbonate	.40
Potassium sulphide	.30
Silver chloride (per oz.)	.65
Silver nitrate (per oz.)	.45
Sodium bisulphite	.10
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.35
Sodium hydrate	.04
Sodium hyposulphite (per 100 lbs.)	3.00
Sodium phosphate	.14
Tin chloride	.45
Zinc chloride	.20
Zinc sulphate	.08

Prices Per Lb. Unless Otherwise Stated.

ANODES.

Nickel	.47 to .52
Cobalt	1.75 to 2.00
Copper	.22 to .25
Tin	.45 to .50
Silver	.55 to .60
Zinc	.22 to .25

Prices Per Lb.

PLATING SUPPLIES.

Polishing wheels, felt	1.50 to 1.75
Polishing wheels, bullneck	.80
Emery in kegs	.4½ to .06
Pumice, ground	.05
Emery glue	.15 to .20
Tripoli composition	.04 to .06
Crocus composition	.04 to .06
Emery composition	.05 to .07
Rouge, silver	.25 to .50
Rouge, nickel and brass	.15 to .25

Prices Per Lb.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents

Montreal, Que., Sept. 13, 1915.—The firm trend and noticeable improvement in the industrial situation is undoubtedly due to the steady demand from Britain and her allies for munitions and supplies, incidental and necessary to the maintenance of men and equipment for the successful prosecution of the war. That still greater activity is about to develop is shown by the meeting held in Ottawa to-day, at which a number of our leading financiers and executive heads of manufacturing establishments discussed ways and means whereby both sections may co-operate with the Government to increase production of war necessities.

It is expected that orders for shells in still larger quantities will soon be placed. One large firm in Montreal, in discussing this feature, said that they had received word from Ottawa, the tone of which was highly optimistic. Some manufacturers are now installing extra heavy tools for the production of 4.5 shells, the expectation being that the near future may warrant them doing so when still larger size shells will be called for.

Many inquiries have been received, and in some cases orders have been placed for lathes of 24 in., 26 in., and even larger sizes, for the production of 6-in. and 9-in. shells for the French and Russian War Offices.

Steel.

The abnormal demand for billets and bars used in the production of various types of shells and component parts keeps the steel mills constantly going at about 100 per cent. capacity, and with orders on their books which cannot be filled for many months to come. If a supply of larger shells is demanded, and this seems more than likely, it will call for increased activity on the part of our steel producers to keep up the required supply of raw material.

Pig Iron

The pig iron market shows little activity, but quotations on the various grades remain firm.

Machine Tools and Supplies

Inquiries for machine tools continue to come in, but in a great number of cases it is almost impossible to have delivery within a period of six or eight months, especially on machines employed in the production of 3.3 and 4.5 shells. The feeling is growing that machine tool builders will soon have to meet the demand for a larger and heavier product to meet the requirements of a correspondingly larger and heavier type of shell.

The demand for supplies, both for the smaller and larger tools, is daily growing greater, and there is little doubt that the near future will see further development in that direction.

Metals.

Very little change is shown in the metal quotations for the week, and as many of the leading manufacturers of brass and copper products are withholding their price lists, it leaves the tone of the market a little uncertain.

Scrap.

The tendency is upward in scrap metals, a slight increase being noticeable in the majority of quotations.

Toronto, Ont, Sept. 14.—Industrial conditions are much the same as last week, but a better feeling prevails in business circles due to the splendid crops in the West, a large yield being now assured. This will stimulate domestic trade, which has been comparatively quiet for several months, but has lately been showing distinct signs of improving. The expansion in the export trade of the country has had much to do with this, as has also the return of a more confident spirit in business circles. There is every reason to expect further heavy orders for war supplies being placed with Canadian manufacturers. It is understood that Premier Borden has been given the fullest assurance by the British Government that for all supplies that have to be procured outside the United Kingdom Canada's resources would be utilized to the fullest extent.

CANADIAN GOVERNMENT PURCHASING COMMISSION

The following gentlemen constitute the Commission appointed to make all purchases under the Dominion $100,000,000 war appropriation:—George F. Galt, Winnipeg; Hormidas Laporte, Montreal; A. E. Kemp, Toronto. Thomas Hilliard is secretary, and the commission headquarters are at Ottawa.

Steel Market.

Reports of the financial condition of the principal steel companies in Canada are exceedingly satisfactory. Conditions in the trade continue to improve, due principally to increasing export business and demand for rounds and forgings for shells. In this regard it is announced that as a result of Mr. Thomas' visit further orders approximating fifty million dollars will be placed in Canada for making munitions. It is further stated that it is the desire of the authorities to place such orders where they can be most speedily and economically filled. Prices on bars, plates, and shapes are very firm, but unchanged. Billets have again advanced, "Bessemer" being now quoted at $24, open hearth $24.50, and forging billets $32, all f.o.b. Pittsburgh. Wire rods have also advanced, and are now quoted at $29 Pittsburgh. With regard to semi-finished steel, it is reported from Philadelphia that competition has appeared in that market from Canadian mills for various sizes of billets and blooms. No sales, however, have been heard of.

There is no abatement in the demand in the United States for open-hearth steel products, much of it being for war munitions. Pittsburgh mills report that they are operating to capacity, and unable to catch up with deliveries. The new demand for plates, shapes, and bars, particularly the latter, is very urgent, and the mills are filled up for weeks ahead. The scarcity of steel-making metal, particularly ferro-manganese, is gradually becoming more acute, and prices for ferro-alloys are advancing. Ferro-manganese is now being quoted at $100 to $110 per ton f.o.b. seaboard. Prices of steel bars have advanced to $1.35 Pittsburgh.

The galvanized sheet market is firming up slightly because of the uncertainty in the price of spelter. The advancing tendency in price of spelter has reduced production of sheets somewhat, as makers do not want to accumulate stocks until the spelter situation clears up. The high-speed tool steel situation does not improve, and prices have an advancing tendency.

Pig Iron

The situation is much the same as last week, and there is a good demand for steel-making pig iron. Prices for American brands are firmer, and grey forge has advanced to $14.70 Pittsburgh. Domestic pig irons are unchanged.

Machine Tools

There is practically no change in the situation as regards machine tools, and no developments have as yet to be noted. The report that further large orders for shells will be distributed may result in further buying of machine tools, although it is highly probable that plants already well equipped will be favored with the greater part of this business. There is every possibility, however, that even these concerns will have to install

more equipment. Inquiries for new machines have fallen off, but there is still a good demand for second-hand equipment. Deliveries in new tools are still very backward and prices have a higher tendency.

Supplies.

Business in machine shop supplies continues brisk, and prices all round are very firm. All American lathe chucks have advanced. "Independent" chucks, which were 20 per cent. off, are now net list, and 12 per cent., has been added to geared scroll chucks. Prices of leather belting are very firm, as there is a great scarcity of hides and a big demand for leather. Half-and-half solder is a little lower, and is now quoted at 24c per pound. The linseed oil market is steadier, but business is very dull. Prices have declined 2c, and oil is now quoted at 63c for raw and 66c for boiled oil per gallon.

Scrap Metals

The scrap metal is firmer, particularly for copper and brass scrap, which have advanced. Heavy lead is also little higher, being quoted at 5c per pound, but tea lead is unchanged. Revised prices are given in the selected market quotations.

Metals.

The metal markets all round are dull and weaker, with lower levels for all, with the exception of tin. The tin market is firm, but dull on account of buyers staying out of the market. There is also little interest being shown in copper, and the market is entirely a nominal one. Spelter has reacted after the advance recorded last week, and lead has also declined slightly. Antimony and aluminum have both declined, and quotations are nominal.

Tin.—The market is stagnant and void of all interest. Buyers have continued to stay out, and the extreme dullness is reflected in the tone being easier. Tin is unchanged at 39c per pound.

Spelter.—The market is dull and lower, with business very dull. Outside of a fair demand for prompt shipments there is nothing doing, futures being entirely neglected. Spelter has declined 1c, and is quoted at 18c per pound.

Copper.—The market is dull, and little interest is being shown by consumers. Quotations have declined ½c, and are nominal at 19c per pound.

Lead.—The market is unsettled and stagnant. The "Trust" has reduced the price to 4.70c, New York. Lead locally had declined ¼c, and is being quoted at 6¼ per pound.

Antimony.—The market is dull and weaker on light demand. Antimony has declined 2c, and is being quoted at 38c per pound.

Aluminum.—The market is entirely nominal. Supplies are so scarce that it is almost impossible to get any aluminum for spot delivery. Quotations are nominal at 38c per pound.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Coaticook, Que.—E. O. Baldwin, Cutting street, will shortly be in the market for hoisting and carrying cranes.

Ford, Ont.—The Ford Motor Co. contemplate building a plant for making farm tractors. No definite plans have been made yet.

Brighton, Ont.—Thos. Garnet & Son contractors, of Port Hope, have commenced the construction of the building for the D. J. Barker Foundry Co. The main structure will be of brick, 220 by 100 feet. Jas. Hickey is manager.

Welland, Ont.—Preparations are being made to re-open the local plant of the Canadian Steel Foundries, Ltd. Operations will first begin in the foundry on shell billets and the rolling mill may open later. Mr. Gilmore is the manager.

Ottawa, Ont.—It is reported that the Government may turn the shops of the Sorel shipyard into a factory for shells, as well as using a private owned factory there for that purpose. This course has been urged by a delegation of members of Parliament for the district.

Electrical

Crediton, Ont.—The council are considering the installation of a power distribution and lighting system.

Granton, Ont.—The town council propose to install a hydro-electric system at a cost of approximately $5,000.

Toronto, Ont.—The Provincial Hydro-electric Commission favor the building of a line from Chatham to Petrolea and Oil City, a distance of about 24 miles. Authority has been given to construct a transmission line for Granton, Kirkton and Exeter, about 24 miles, and also a line from Lucan to Ailsa Craig, nine or ten miles. It is expected that power will be turned on at Eugenia Falls about the first of next month.

Municipal

The Pas, Man.—Work will be proceeded with on the waterworks and sewage disposal plant.

Edmonton, Alta.—Work has started on the sewage disposal plant. The cost is estimated at $30,000.

Liverpool, N.S.—The Town Council contemplate making improvements to the municipal electric light plant.

Brantford, Ont.—The Fire and Light Committee have decided to purchase a motor truck for the fire department.

Esquimalt, B.C.—The City Council contemplates submitting by-laws to the ratepayers to authorize the raising of $30,000 by debentures to provide for the building of a fire hall and the purchase of fire apparatus.

Armagh, Que.—The Armagh Electric Co. propose to supply light and power to several villages in the County of Bellechasse. Joseph Leclere, Mayor of St. Charles, Que., is president of the company. Contracts will probably be let shortly.

ALLIES PURCHASING AGENTS

The Trade and Commerce Department, Ottawa, has published the following list of purchasing agents for military purposes for the allied Governments:

International Purchasing Commission, India House, Kingsway, London, Eng.

French.—Hudson Bay Co., 56 McGill Street, Montreal; Captain Lafoulloux, Hotel Brevort, New York; Direction de l'Intendence Ministere de la Guerre, Bordeaux, France; M. De la Chaume, 28 Broadway, Westminster, London.

Russian.—Messrs. S. Ruperti and Alexsieff, care Military Atache, Russian Embassy, Washington, D.C.

Windsor, Ont.—Definite steps for the acquisition of the street railway lines in Windsor, Walkerville, and Sandwich by the municipal interest will shortly be taken if a recommendation of the Ontario Hydro Commission meets with the approval of the councils of the three townships.

General Industrial

Montreal, Que.—Robin Bros. are building an extension to their factory.

Redvers, Sask.—The Imperial Oil Co. has obtained a track site here and will erect tanks this fall.

Winnipeg, Man.—The Peabody Overall Co., of Walkerville, Ont., may build a factory here for supplying the West.

Montreal, Que.—The Mount Royal Color & Varnish Co. will build an extension to their factory at a cost of $20,000.

Brantford, Ont.—The Brantford Cordage Co. will build an addition to their factory. C. L. Messecar is the general manager.

Salem, Ont.—The Salem tannery was burned down on September 4, and is a total loss, this being estimated at $3,000, with $1,000 insurance.

Chatham, Ont.—The Ideal Electrical Mfg. Co. of Wallaceburg is going to move to the city shortly. This is among the oldest establishment in Canada making electrical heating goods.

Contracts Awarded

Berlin, Ont.—George Moogk, of Weston, has been awarded the contract for the construction of an extension to the sewer disposal plant this fall. His tender amounted to $43,512.75.

Lachine, Que.—The City Council have awarded a contract for the construction of an incinerator of the "Decarie" type to the Atlas Construction Co. of Montreal. The plant will have a capacity of 20 tons per 24 hours.

Hull, Que.—The City Council has awarded the general contract for the construction of a hydro-electric plant to the Canadian General Electric Co. at $34,840. Works include power house, draft tube, open flume and gates.

Tenders

Victoria, B.C—The City Council have for sale a quantity of contractors' equipment. Full information may be obtained from the city purchasing agent at the City Hall.

Chatham, Ont.—The city engineer, F. P. Adams, is open to receive tenders for the machinery and equipment of the Chatham electric light plant, which consists principally of gas engines and producers, and electric generators.

Forging and Machining Shells in a Locomotive Works

Staff Article

In the plant here described, an output of 3,000 shrapnel of 3.3 diameter and about 1,500 or 1,800 high explosive shells of 4.5 calibre is being forged each 24 hours. The machining on the 3.3 shrapnel is proceeding almost as fast as the equipment can handle the work and a large shop is being equipped for machining the equivalent in 4.5 howitzer shells.

AMONG the many Canadian plants engaged in the production of war munitions, the most advantageously situated seem to be those which do both the forging and machining of shrapnel and explosive shells.

When the question of manufacture of these implements of war was first brought to the notice of the Canadian industrial world, it appeared to be a somewhat difficult matter to decide just where a start was to be made, but when the question of supply was taken over by a Commission of men well fitted and adapted to the control of an urgent and serious situation, a system was planned and developed whereby shell manufacture has not only been accomplished with good success, but at the present time is one of the greatest activities in progress throughout the length and breadth of our Dominion.

At the initiation of this new industry, forging was done principally, if not entirely, by our large steel plants and foundries, but as the demand for forgings became more and more insistent, developments naturally followed, with the result that at the present time many plants are producing shells all the way from the unforged billet to the final loading. Among the first to undertake this branch of the new activity were our large locomotive works.

Cutting Off the Billets.

In the production of 3.3 shrapnel shells in this particular plant, the $3\frac{1}{2}$-inch bars of 0.50 carbon steel are received from the mills in various lengths and are cut up into billets $4\frac{7}{8}$ in. long. The billets are produced in a number of different machines. A "Newton" cold saw is employed in cutting off four pieces at a time, blocks having the necessary shape being placed between the jaws of the vises so that the teeth of the saw start cutting on the four bars at once.

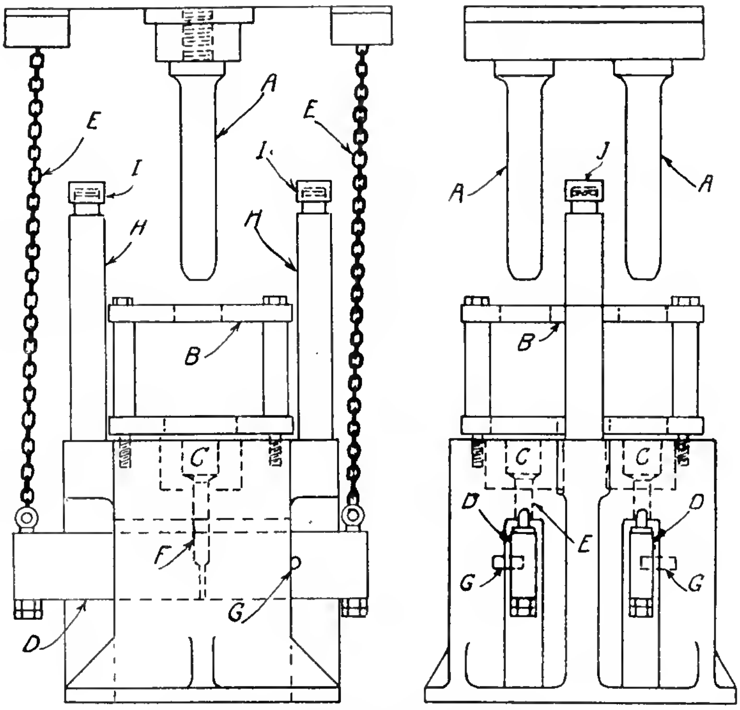


FIG. 2. GENERAL FEATURES OF R. D. WOOD CO. PRESS ATTACHMENTS.

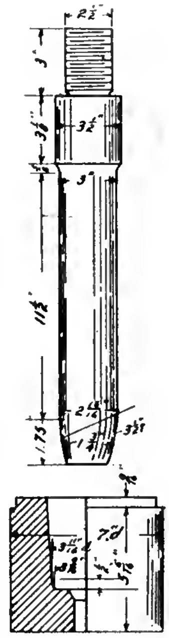


FIG. 2A. PUNCH AND DIE FOR PIERCING.

Planers were at one time used to cut the bars into billet lengths, but this method has now been discontinued. A very much similar arrangement is, however, employed on two large "Niles-Bement-Pond" millers as indicated in Fig. 1. Clamping devices rigidly secured to the table hold 32 bars at one setting and eight large Disston cold saws cut off the billets. The travel of the table is completed in thout two hours, and when it has gone about half way, men at the rear remove the billets and set up another set of bars in their place, so that when the table has completed its travel the cutting arbor is raised and the table returned to commence cutting at the other end. The later cut billets are then removed and are replaced by bars, the cutting-off process being thereby almost continuous. This accomplishment

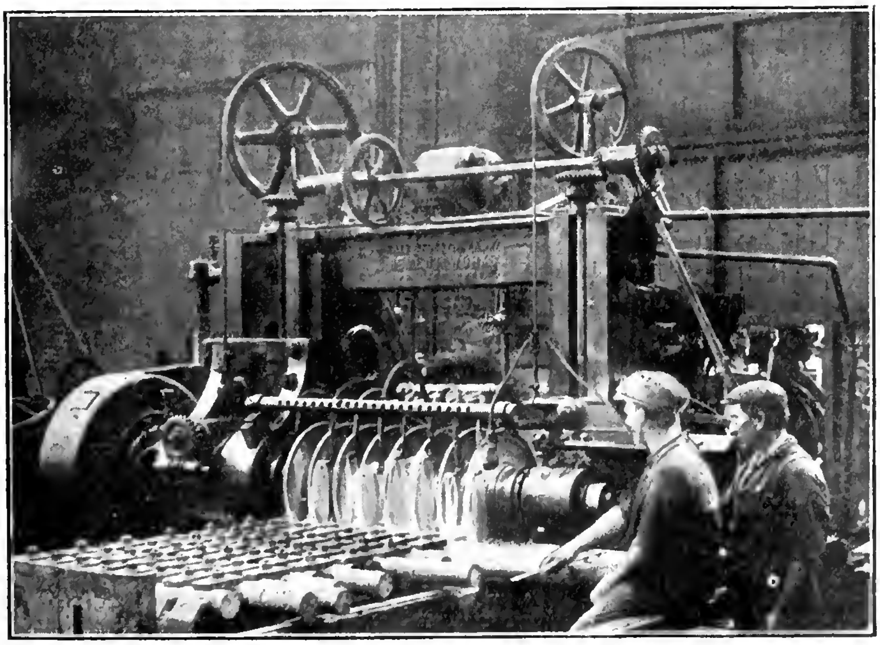


FIG. 1. CUTTING-OFF 3.3 HIGH EXPLOSIVE SHELL BILLETS ON A "NILES-BEMENT-POND" MILLER.

was impossible in the case of the planer. At each traverse of the table 250 billets are secured. A third and similar machine will soon be in operation for the production of billets.

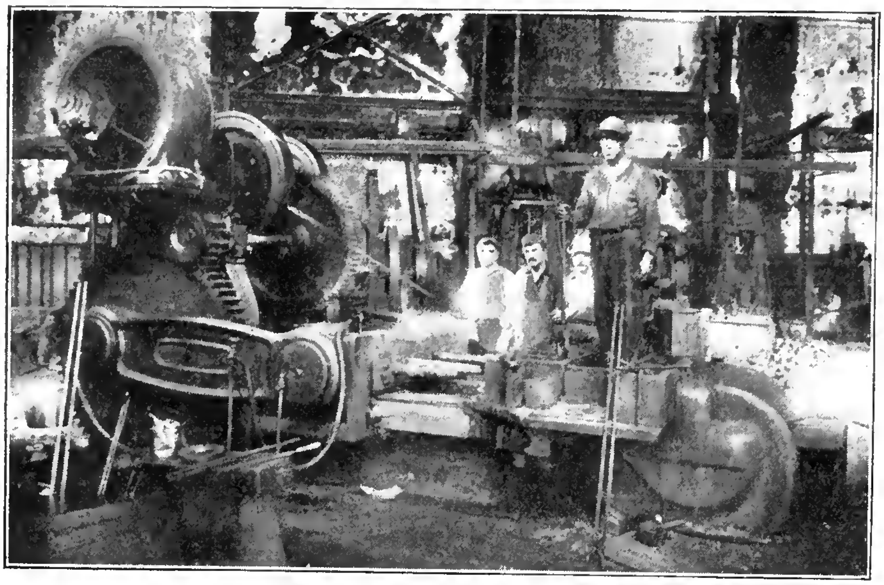


FIG. 3. BULLDOZER USED IN SECOND DRAWING OPERATION OF 3.3. SHRAPNEL SHELL FORGINGS.

Turret lathes are also used in cutting off billets, these having a capacity of about 260 per 10 hours.

Forging.

In preparation for forging, the billets are placed in furnaces made by the Ferguson Furnace Co. There are two of these furnaces to each press. The fuel used is crude oil, at a pressure of 25 lbs., mixed with air at a pressure of 7 ozs.

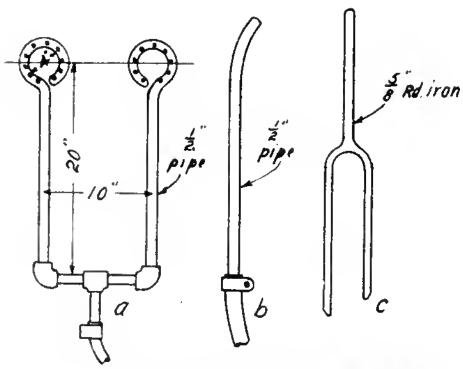


FIG. 3A. FORGING PRESS ACCESSORIES.

The presses installed were supplied by the R. D. Wood Co., Philadelphia, and Fig. 2 shows the general design of the different attachments.

The punches, A, are secured to the ram of the press, and in their downward stroke pass through the plate B, which is held up a certain distance by means of bolts and blocks as shown. This plate with the aid of a hand tool strips the stock from the punch after it has been pierced. The dies, C, are held in position in the bed of the press, while the cross-bar, D, is for the purpose of knocking out the block after the piercing has been performed.

This cross-bar D is held up by the two chains E on either side, the top end of these being secured to the moveable ram, which carries the punches. It will be noticed that the chains incline at an angle, the reason of this being that as the ram descends, and likewise the chains and cross-bar, the bar will fall away from the knock-out bolt F, and by action of gravity, the cross-bar will fall to a central position, and on the upward stroke, the solid part of the cross-bar comes in contact with the bolt F and ejects the work from the die.

When the ram has reached the top, the operator forces the cross-bar over until the stop pin G engages with the frame of the press, following which the knock-out bolt drops into the hole of the cross-bar. To regulate the stroke of the punch into the work, the caps I are placed on the top of the standards H, and as the punch wears or the piece I upsets, one or more washers shown at J are taken out.

In Fig 2A is shown a sketch of the punch and die used in the R. D. Wood presses for the piercing operation, and in Fig. 3 A are a few useful devices used while forging. A spraying arrangement for cooling the punches is shown at (a), and (b) is an air pipe for blowing the scale out of the dies; while (c) is a gauge for testing the length of the shell after drawing.

Piercing and Drawing.

In one section of the plant where two presses are conveniently placed, the piercing and drawing operations are accomplished at one heat, but in most cases it requires two heats to complete the forged shell.

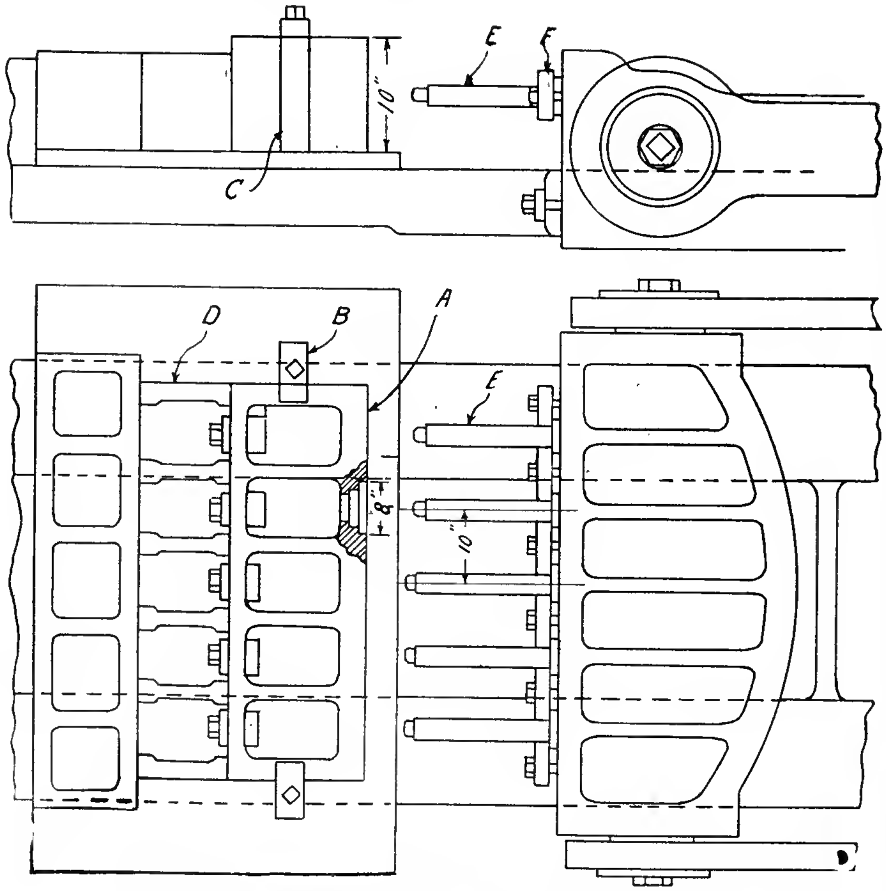


FIG. 4. CONSTRUCTIONAL FEATURES OF BULLDOZER ATTACHMENTS FOR DRAWING SHELL BILLETS AFTER PIERCING.

The Bulldozer.

Fig. 3 shows a large bulldozer used in drawing the shell after it has been pierced in one of the other presses. While in the hydraulic presses the shells are forced through the two or three dies at one time, one die being placed above the other, in the bulldozer each sizing die

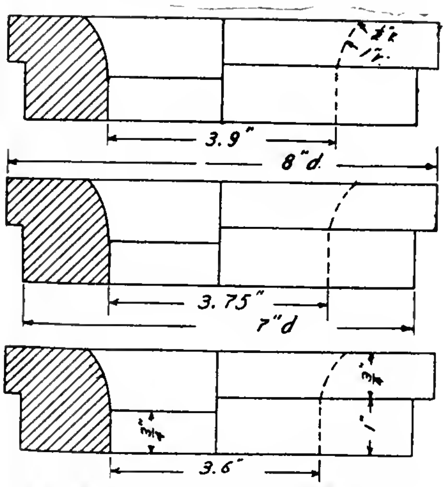


FIG. 5. FIRST, SECOND AND THIRD OPERATIONS ON BULLDOZER.

is separate. The pierced block is heated and passed to the man on the press, who receives it with a pair of tongs. The base end is then held in the die and the punch coming forward enters the hole and forces the piece through; in the interval, the man on the press changes his tongs for a stripper tool, similar to a fork, which passes over the punch as it protrudes through the die, and, in receding, the work is removed and passed on to the next die to be reduced in size.

The constructional features of the bulldozer are shown in Fig. 4. The large casting A which carries the drawing dies is held down on the table of the machine by means of the clamps B and blocks C. Distant pieces D are placed between the die block A and the tail-piece of the machine, so as to bring the dies into the desired position. Instead of screwing the punches E into the movable ram, they are made with a square shoulder and fastened in position by the clamps F. Fig. 5 is a sketch of the three dies used in the three draws on the bulldozer.

Automatic Attachments.

In the drawing operations on these presses, owing to the heat generated from the large furnaces and the nature of the work, there are times when through forgetfulness or carelessness, the movements of the attendants are sometimes slow, or inaccuracies arise in operating the various hand appliances for forming and stripping the shells. To eliminate these to some extent, the works engineer designed and constructed several attachments and placed them upon a large "Niles" hydraulic press. These automatic arrangements of stops and strippers are operated by levers, controlled from a cylinder supplied with compressed air. At the proper moment by action of trip-levers, these stops and strippers are brought into position, thus overcoming the uncertainty of the human element.

Forging Requisites.

In all these forging operations it is very important that a large percentage if not all of the scale should be removed before the shells are placed in the die. A jet of water is sometimes thrown on the block as it comes from the furnace, and by a sudden blow or the action of scrapers a great deal of the scale can be removed.

Proper lubrication is another essential feature in connection with the forging operations. In many cases, flake graphite or a solution of graphite and oil applied with a swab is being used with very good results. Proper temperature in heating should also be carefully considered to obtain satisfactory results. For the piercing operation a heat of 2,000 deg. F., and for the drawing operation 1,800 deg. F. is considered good practice.

Another important feature is the speed with which the operations are performed, an average speed of 30 feet per minute for piercing and a speed of about 22 feet for drawing, usually give satisfaction. Increasing or reducing these speeds previously gave some trouble. By

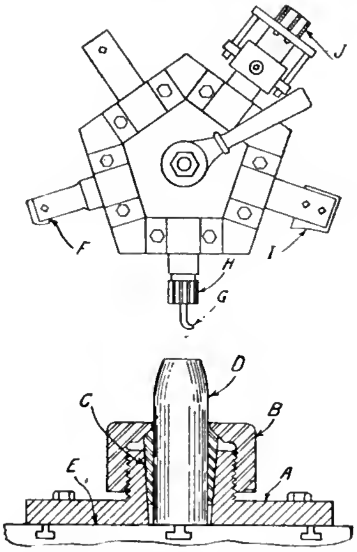


FIG. 6. CHUCK AND HEAD ON "BULLARD" VERTICAL TURRET LATHE.

proper heating and handling very few spoiled or rejected shells may be anticipated.

Inspection and Machining.

After the shells are inspected they are sent to the machine shop. The cycle of operations from the forging to the finished shell are similar in this plant to many of those already described in **Canadian Machinery**, and only a few operations and special appliances need therefore be mentioned here.

Machining Shell Nose.

Fig. 6 shows a special chuck used on the table of a "Bullard" vertical turret lathe for holding 3.3. shrapnel shells while the noses are being machined. The casting A is secured in a central position on the lathe table E, the bore of this piece being turned to fit the split bush C, the bore of which fits the shell after it has been rough turned. The nut B which is screwed down with a large wrench, forces the bush C down, securely gripping the shell D.

Directly above this jig is shown a sketch of the turret head carrying the tools required in the nosing and threading operations, which consist of face, bore and ream, undercut, turn contour and tap. A view of the operation is shown in Fig. 7.

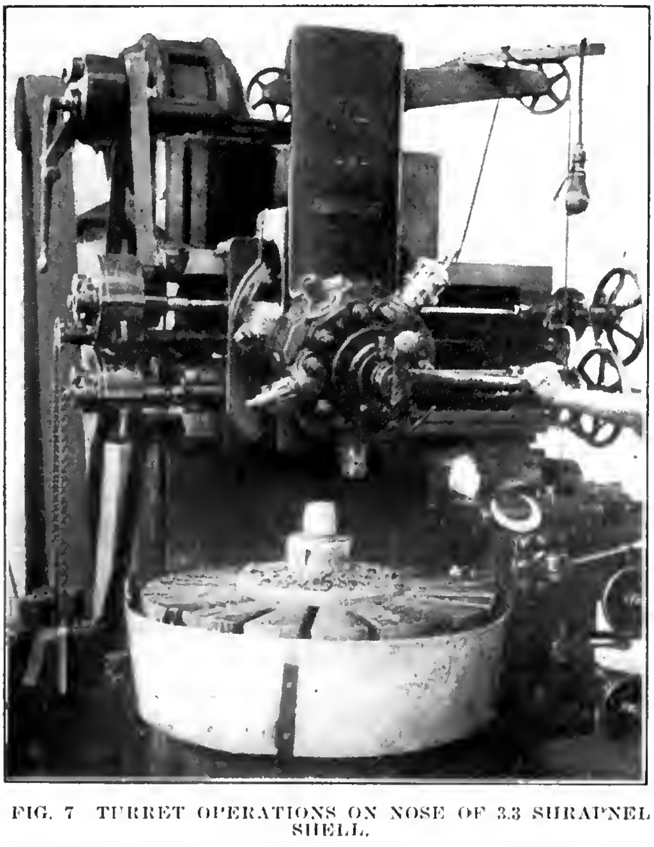


FIG. 7 TURRET OPERATIONS ON NOSE OF 3.3 SHRAPNEL SHELL.

Stop Gauge.

A very convenient stop gauge is shown in Fig. 8

for use when roughing out the groove for the copper band. The shell A being placed in the chuck B, the stop C (which is pivoted on the piece D, held

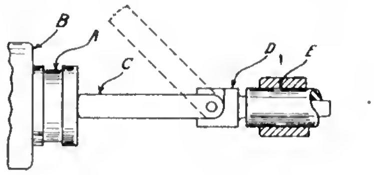


FIG. 8. STOP GAUGE.

in the tail-stock spindle E), is swung into a parallel position, and the shell brought forward until it strikes the stop, the chuck being then tightened and the stop swung clear as indicated by the dotted lines.

Fig. 9 shows a useful chuck for holding the shells while facing, or grooving and waving. It is somewhat similar to that shown in Fig. 6, only that the nut C bears on the split bush D on a flat surface instead of on a taper. A view of the bush D is shown to the right.

Dressing Wheels.

Many devices are employed for dressing formed grinding wheels, that shown in Fig. 10 being very convenient and serviceable. The compound rest A is placed

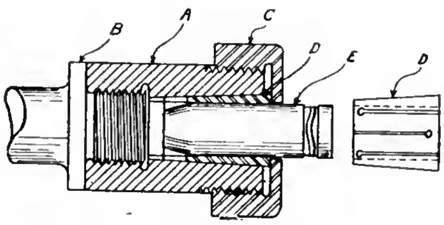


FIG. 9. SPECIAL CHUCK.

on the machine, a "Landis" grinder, to one side of the shell, and, when the wheel needs dressing, the table is brought back and the wheel dressed to shape. Secured in the slot is the forked piece B carrying the bell-crank piece C, which swings about the pin shown. The piece C carries at the lower end a diamond dresser which is held in position by the set-screw; this piece C also carries a roller E which is kept in contact with the cam D by the action of the spring beneath the tail of the piece C.

Special Driving Chuck.

Another simple and useful contrivance is shown in Fig. 11, its purpose being to hold the shells while the copper band is being turned. The friction chuck which drives the shell is held in lathe spindle A, and to support the finished end of the shell, the device shown gives very satisfactory results. The piece E which is held in the tail-stock spindle F has a stem on its outer end which carries the revolving piece D, this latter being recessed on the end to fit the base of the finished shell. To avoid undue friction, a number of balls are used between the two surfaces.

Lead Pot Heating.

In connection with the nosing of 3.3 shrapnel shells, the open ends are heated in a pot of molten lead, a sketch of the latter being shown in Fig. 12. This pot is placed in a furnace built of boiler plate and fire brick, the fuel used being crude oil. For some time, owing to the evaporation and lead clinging to the heated shells, a loss of 100 lbs. of lead for every 120 shells nosed was sustained.

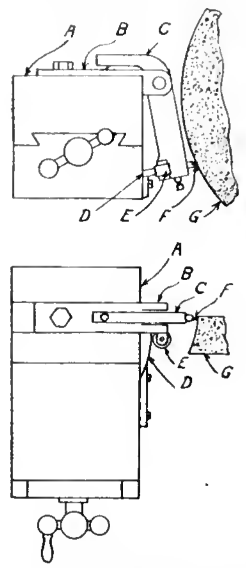


FIG. 10. JIG FOR DRESSING EMERY WHEEL.

The works chemists suggested covering the surface of the lead with broken charcoal, with the result that the wastage is now only about 20 lbs. per 500 shells, the bulk of which is what sticks to the latter. In all lead-pot heating, the charcoal protection is advisable, as, unprotected, the lead hardens and depreciates rapidly.

Forging 4.5 H. E. Shells.

High explosive shells of the 4.5 size are also being produced in this plant. The billets are received from an adjacent steel foundry, being there cast in ingots about 30 inches long, each ingot making two billets. About 40 per cent. of the ingot at the top is removed to avoid the possibility of a "pipe."

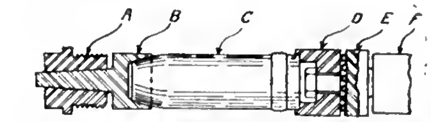


FIG. 11. CHUCK AND BALL-BEARING CENTRE.

The forging of these billets into rough shells for 4.5 projectiles is at present being done in one operation, but not with entire success. Much experimenting is being carried on in the hope that one operation may be all that is necessary. Trouble is being experienced with the walls varying in thickness to the extent that a number of the rough forgings do not pass inspection.

Machining 4.5 H. E. Shells.

In the machining of the 4.5 high explosive shells, eight to ten American Tool Co. lathes and about thirty R. K. Leblond lathes fitted with turrets are employed, while for threading the recess in the shell base, "Lees-Bradner" threading machines are installed. The sequence of operations is similar to those of the 3.3 shrapnel, and along the lines

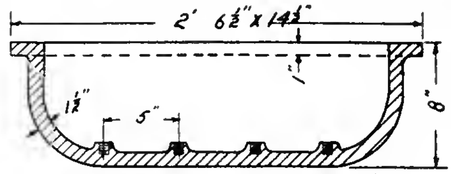


FIG. 12. LEAD MELTING POT.

described in previous articles in **Canadian Machinery.**

For facing off the base, the shells are held in the device shown in Fig. 13. Old engine lathes and cutting-off machines are also employed on this operation. The shells are next centered and rough turned.

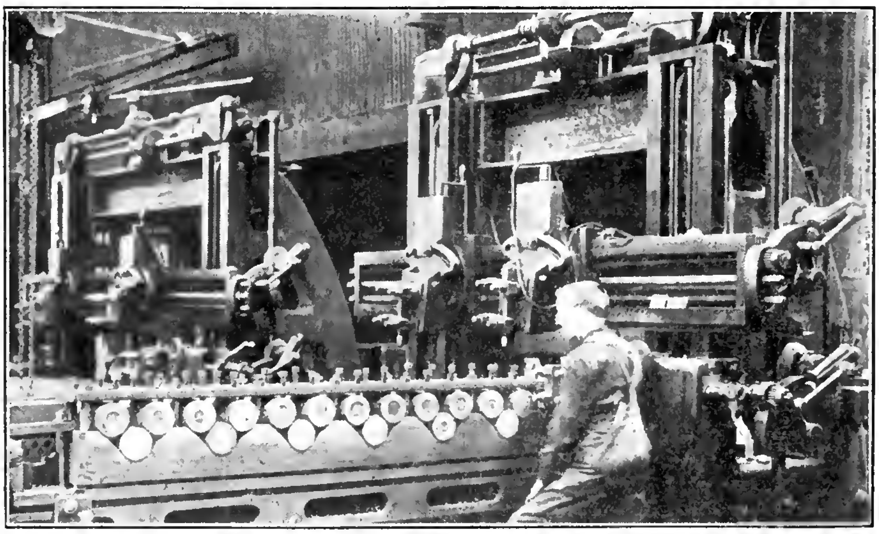


FIG. 13. FACING OFF BASES OF 4.5 HIGH EXPLOSIVE SHELLS.

The boring is accomplished by holding the shell in a chuck similar to that shown in Fig. 9, and the operation is performed as indicated by Fig. 14. The powder chamber is roughed, and the nose shaped inside with the first tool shown in the figure. The second tool is for boring and the last for finishing the bore and powder chamber.

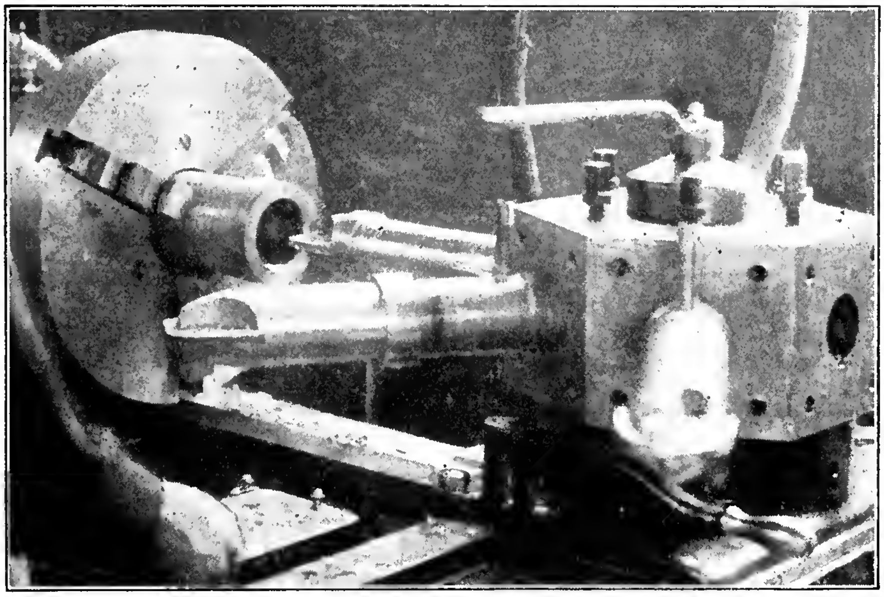


FIG. 14. BORING 4.5 H. E. SHELLS ON A 21-IN. "LE BLOND" HIGH DUTY LATHE.

After the shells have been nosed in the nosing press, they are finish turned, the contour of nose is formed; the grooving and waving is completed, and the inside of nose finished and tapped. This operation is shown in Fig. 15. The nose is rough bored and reamed, shaped at base of thread, grooved and tapped with "Murchey" collapsible tap. During these operations the shells are held in a chuck similar to that shown in Fig. 9, but larger.

After the machining is completed the interior is varnished and afterwards baked in an oven or hot plate for several hours at a temperature of about 300 degs. F. The brass sockets are next screwed in, the finishing of same being performed on 21-in. "LeBlond" lathes.

FIG. 15. FINISHING INSIDE NOSE OF 4.5 H. E. SHELL ON A 21-IN. HIGH DUTY "LE BLOND" LATHE.

EFFECT OF HUMIDITY ON LEATHER BELTING

IN a paper on "The Effect of Humidity on Leather Belting," presented at the Buffalo meeting of the American Society of Mechanical Engineers, the following conclusions were arrived at:—

(1)—If a belt be set up at low relative humidity, slipping will probably occur if the relative humidity increases to any great extent, especially if accompanied by a rise in temperature.

(2)—If a belt be set up at high relative humidity excessive pressure on the bearings and stretching of the belt will result from a decided decrease in relative humidity, especially if accompanied by a fall in temperature.

(3)—If a belt be set up at a medium relative humidity, the tensions will not be excessive at lower relative humidities, nor will there be any great danger of slipping at high relative humidities unless accompanied by excessive temperature changes. In other words, the factor of safety in the ordinary belt rules is sufficient to provide for the effect of changes in the relative humidity, if the set-up be made at a medium per cent. of relative humidity.

(4)—If a belt be set up at any relative humidity with a spring or gravity tightener, a load 50 per cent. greater than the standard can be transmitted at either high or low humidity without encountering any danger of stretching the belt, of slipping, or of any excessive pressure on the bearings.

NOVA SCOTIA STEEL & COAL CO.

IT is learned on good authority that during the month of August nearly 220,000 forgings for shrapnel and high explosive shells were manufactured by the Nova Scotia Steel & Coal Co. This output exceeded that of the previous month by 25 per cent., and was the best month the company has experienced since its entry into the munition business.

At the present time four sizes of shells are being forged. Besides completing approximately 10,000 forgings daily, the company is turning out about 1,000 complete shells. Up to the present it has turned out nearly two million forgings, which have been distributed among Canadian firms participating in shell machining.

In addition to the shell business there is much manufacturing activity in heavy marine forgings for shipbuilding concerns on the Clyde. Before the outbreak of hostilities nearly all work of this class was handled by German firms. Last fall an order was received for 3,000 tons, and it will not be completed until about the end of the year.

The Scotia Company will have the biggest steel output this year in its history. At present the greater part of the mill is being worked twenty-four hours a day, divided into three eight-hour shifts. There are about four thousand men on the payroll.

Operations at the Eastern Car Co., a subsidiary, are not yet at capacity, but this is entirely due to lack of suitable labor. About forty cars per day are now being manufactured, and it is expected that this output will be increased to fifty cars within the next few weeks. All this business is for export.

PRODUCTION METHODS AND DEVICES

A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

EMERGENCY GEAR CUTTING

By S. Simpson

THE machine for knurling small brass gear teeth described by Avery E. Granville in Aug. 26 issue of **Canadian Machinery** represents what is presumably one of the latest developments of gear making equipment. Having frequent repairs to make to all kinds of talking machines, the writer is occasionally called upon to make an odd gear, and the method adopted, while ef-

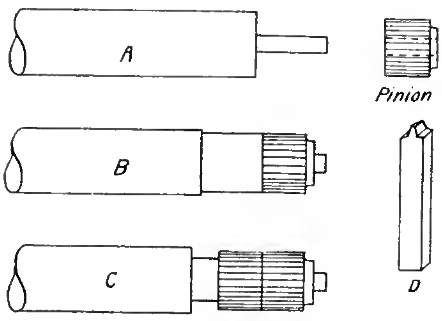


FIG. 1. EMERGENCY GEAR CUTTING.

fective, forms so great a contrast that a brief description may be of interest to your readers.

Owing to the lack of a dividing head or a milling machine, the work had to be done in a lathe. To begin with, chuck a piece of brass rod or cold-rolled steel, as the case may be, and turn it down as shown at A, Fig. 1. Make the end a suitable driving fit for the old pinion so that it can be driven on without distortion, either of itself or the rod; see B, Fig. 1. Now turn tbe rod to the same size as the pinion, just touching the tops of

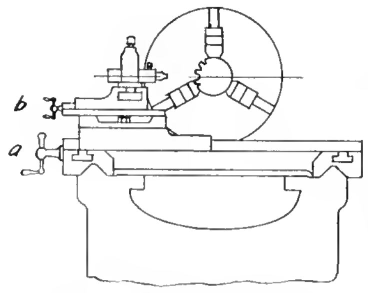


FIG. 2. EMERGENCY GEAR CUTTING.

the teeth with the tool. Carry the cut far enough along to allow the full width of teeth on the new gear, and then recess as at C, Fig. 1. Make the diameter of this recess just slightly smaller than the bottom of the teeth of the old pinion.

A piece of square tool steel is now filed up carefully to fit the space between the teeth of the old pinion, due allowance being made for effects of wear where noticetble; see D, Fig. 1. This tool is now fastened in the tool post with its cutting edge facing toward the chuck, being set level with the centre. The chuck is then moved round till the tool feeds in free, and bottoms between the teeth. The chuck is next wedged tightly with a block of wood, after which work may be started. The carriage, Fig. 2, is fed sideways by handle (a), the depth of the cut being adjusted by handle (b). After cutting one tooth, the wedge is loosened and the chuck moved round till the next space in the old gear is matched up with the cutting tool.

After completing the teeth, the stock is bored from the inside of the old pinion a hole o,f the proper size being carried through far enough so that when cut off on the other side, the new pinion has a finished hole and is completely machined.

TOOL STEEL FROM SCRAP.

By E. Avery

AN Eastern man claims to have perfected a process by which he can easily change almost any piece of ordinary iron into tool steel. The process is very similar to that of case-hardening, but goes entirely through thin metal, and much deeper into thick pieces, than does case-hardening in the same time. He calls it "infusion" and the mixture he uses to accomplish his results is a secret. After being treated, the metal is hardened and tempered in the ordinary way, and the results are surprising in some

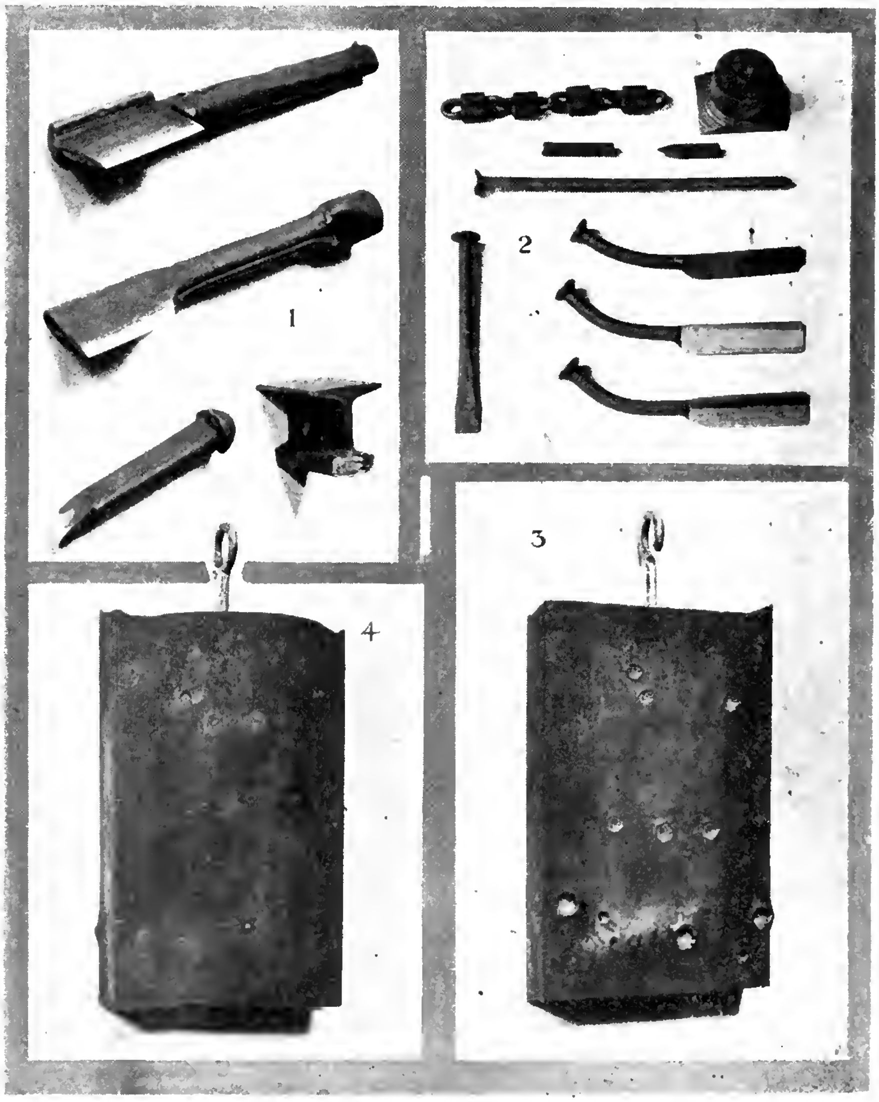


FIG. 1. RAZORS MADE FROM GAS PIPE, AND A LATHE TOOL MADE FROM A RAILROAD SPIKE. FIG. 2. RAZORS AND CHISEL MADE FROM WIRE NAILS. FIG. 3. EFFECT OF BULLETS ON UNTREATED PLATES. FIG. 4. BULLET MARKS SCARCELY SHOW ON TREATED PLATES.

instances. His claim is that his process enables a manufacturer to buy cheap steel, which can be easily machined into milling cutters, gears, or other things, and then, treated by his process for a trifling sum, changed into a high-grade of tool steel with all the properties of the best steel of this kind. While manufacturers in general have looked upon the process with suspicion, and demand rigid tests before trying it, some of his results are interesting.

Fig.1 shows two razors made from pieces of ordinary gas pipe, and a lathe tool made from a railroad spike. The piece of railroad rail shown, was used as a test piece. The razors and tool, gave very satisfactory results, when properly used.

Fig. 2 shows three razors and a chisel made from common wire nails, together with some miscellaneous parts. These all compared favorably with similar tools of first class steel.

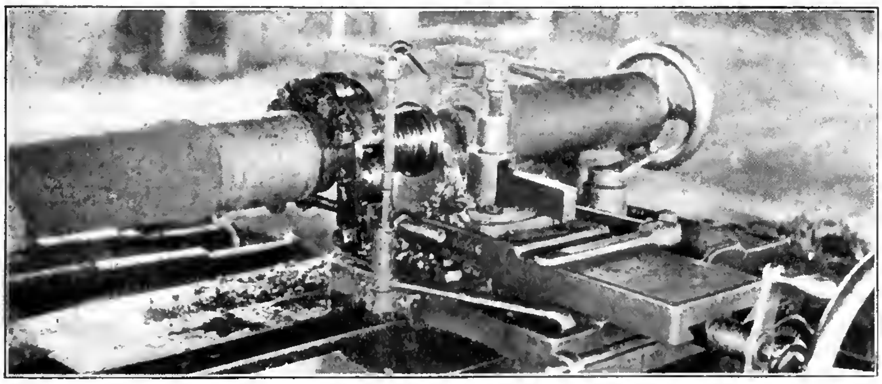
Fig. 3 shows a large untreated iron plate which was fired at with a Springfield rifle, the bullets making very noticeable indentations.

Fig. 4 shows a treated plate, subjected to the same test, the bullet marks scarcely showing.

AN AXLE ROLLER

By G. Edwards

ONE of the shops of the Pennsylvania Railroad system uses the device shown for rolling car axles after they are turned. This gives the bearing surface a hard smooth finish that cuts the journals less than if the axle were merely finish-turned. The device consists of three hardened rollers set in links so as to bear about 120 deg. apart when applied to the axle. Pressure is supplied by means of an eye-bolt, the nut of which is tightened sufficiently to give the right finish. The bracket holding the device is bolted to the side of the lathe carriage, and the eye-bolt has a pin in it which locks it to the end link which may be easily removed when the tension is released. This allows the links to be disengaged and swung back out of the way while the bearing is being turned in the first place. When the rollers are in place they are fed along by means of the power feed exactly the same as is the cutting tool.

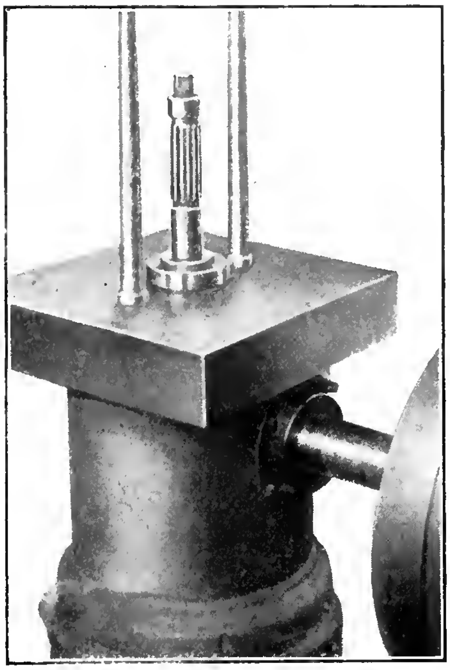


DEVICE FOR ROLLING CAR AXLES AFTER BEING TURNED

PULLEY REAMING MACHINE

By A. E. G.

A CONCERN having a large number of pulleys to ream, built the machine shown.



PULLEY REAMING MACHINE.

Adjustable reamers are used in the spindle, which is provided with bushings for holding various sized shanks. The bored-out pulley is placed over the reamer so that the arms or spokes will rest against the two uprights set into the table; the pulley is then slowly pressed downward. The bushings in the spindle do not clamp the reamer shank but merely hold it central, the driving being done by means of the square on the end of the shank. This allows the reamer to be lifted out as soon as the pulley has been reamed, and does away with the necessity of running the reamer back through the hole.

CUTTING QUALITY AND HARDNESS

A GOOD many many machinists hold the mistaken notion that hardness in a cutting tool is the same thing as cutting ability, and are disposed to condemn or approve a tool according as it can or cannot be scratched with a file, says a writer in the "Manchester Guardian." The fact is, of course, that extreme hardness is only of service in rare cases when very hard metals have to be machined, and that for the general run of work a tool that can easily be filed may give the best results.

Particularly does this apply to modern high-speed steels, for these, when hardened to perfection for heavy cuts in mild steel or cast iron, hardly ever exhibit extreme hardness. In the case of lathe tools, one reason for this probably is that in heavy and fast cutting the point of the tool plays little part in severing the chip from the body of the work; the separation proceeding by a continuous splitting action which opens out a way for the point. Consequently, with even a moderately soft point, the edge is not easily rounded and the action in any case not much impeded.

In the case of high-speed drills working in mild iron or steel, extreme hardness is to be avoided, or trouble will arise from the snipping of the cutting edge and the breaking of the drill itself. A cutting tool should, therefore, never be judged by its hardness as tested by filing, but solely by its performance of the task for which it is intended.

CANADIAN FORD CO.

BIG things are expected of the Ford Motor Co. of Canada, of Ford, Ont. Net earnings for the present year are estimated at $3,000,000, or 300 per cent. on the capital stock. People in Detroit, who are in close touch with the company, express the opinion that a stock dividend between 600 and 700 per cent. will probably be announced this fall. The regular dividend is 40 per cent. cash per annum.

The company has a record for making distributions in stock, and its present capital, $1,000,000, represents a growth from $125,000 in 1906 through the declaration of stock dividends.

Through agreement with Henry Ford, the company sells Ford products without competition in Canada and the British Colonies, which includes Australia, India, British South Africa and New Zealand. It does not, however, sell in the British Isles.

In 1912, the Ford Motor Co. of Canada sold 6,300 cars; in 1913 it sold 11,000; in 1914, 16,500; while this year's business, notwithstanding adverse conditions in many parts of its field, will be close to 25,000 cars.

NEW PROCESS DEVELOPMENTS

Inventive Genius and Research Operate to a Dual End — They Aim to Improve What We Now Possess and Bring to Our Service Commodities Before Unknown

ELECTRIC ARC WELDING*

By Lieut. C. S. McDowell, U.S.N.

WELDING is the joining of two pieces of metal of like or unlike characteristics by fusion, while in the plastic state. The old definition of welding was the process of uniting two pieces of metal by hammering them together while hot enough to be plastic. Modern methods, however, of obtaining high temperatures by means of gases and electricity, has broadened the definition of welding and brought in use additional processes, to which the term "welding" has been applied. It is the purpose in this article to describe only the Electric-Arc Welding process, which it is predicted will rapidly become the standard method of joining sheet metals of all thicknesses, reclaiming castings, repairing broken machinery of all kinds, building up of worn parts, welding seams in new boilers, tanks, etc., making of high-speed tools, repairing boilers, etc., and an arc-welding equipment will be a necessary adjunct to every properly-equipped machine shop.

Conditions for Successful Welding

The essential characteristics of a successful weld are:—That the metal in the welded joint shall be free from impurities, slag and defects of all sorts; that it shall possess a sufficient amount of elongation, flexibility and tensile strength; and that the process of welding shall be such as to reduce to a minimum disturbances in the texture of the surrounding metal. In certain classes of work, flexibility and elongation in the weld is of more importance than tensile strength. The quality of the weld obtained with electric welding is dependent on the following:—

1.—The furnishing of the correct amount of energy at the weld for obtaining of the proper working temperatures of the material to be welded.

2.—The quality of the metal electrodes (the welding wire).

3. The skill of the operator.

The Correct Amount of Energy

The material worked on, the anode, is heated by the impinging of the cathode stream, by the julean heat developed by the ohmic contact resistance and by the radiant heat given off the arc: the metallic pencil or cathode is heated by the julean heat due to its ohmic resistance to current flowing and by the slight contact resistance at the electrode surface. The greater proportion of the heat generated at the arc is at the anode, or material being welded (approximately 75 per cent. of the total heat), when the metallic arc is used. This is quite satisfactory due to the greater means of dissipation at the anode by radiation, convection and conduction.

Practically all the energy supplied to the arc is dissipated as heat, only a slight proportion being given off as light, and to regulate the amount of heat units and thereby the temperature of a particular shape and class of material, it is essential to regulate the amount of energy supplied to the arc as measured in watts. The maximum temperature of steel in the usual converter is approximately 1,800 degrees C., the melting being approximately 1,400 degrees C. The temperature of boiling steel at atmospheric pressure is approximately 2,450 degrees C., while the temperature of the arc stream may greatly exceed this. The result is that in electric-arc welding steel is being worked near a critical temperature.

The material to be welded should be in a plastic state sufficient for the proper intermixing of the metal and obtaining of perfect fusion: if the temperature be too low the added material will not adhere to the original metal and the weld will fall apart at the surface: on the other hand, if too high a temperature is obtained the metal will be burnt and the weld will be greatly weakened by slag thus formed and will be of coarse and irregular structures. The surfaces of the metals to be welded must tend to cohere to a marked extent, and the working temperature must be that at which the foregoing condition is most prominent.

Welding Condition Feature

The best welding condition for iron and steel exists within a limited range of temperature only. The safe working temperature depends somewhat on the material to be welded; an operator quickly obtains the necessary experience to tell if he has the proper temperature. The amount of energy necessary to obtain the proper temperature at the weld depends upon the size and shape of the piece worked on, it being the amount of energy necessary to supply the heat losses and keep the weld constantly at the proper welding temperature. The amount of energy required varies as the whole mass of the article becomes heated, a greater amount being required at first when the mass is cold; for this reason it is important in order to obtain consistent results to have a control of the energy at the operator's end of the line. This control should require very few changes in the supplied energy and is not to overcome the variation of energy due to changes in arc length. The temperature at the weld should remain practically constant; a momentary inrush of current will burn the metal at that point and cause a flaw with the chances of reducing the tensile strength of the weld 50 per cent., or even more.

Electrodes

There are two methods of electric-arc welding: one, the Benardes process, in which a carbon electrode is used; and the other, the Slavinoff process, in which the metallic electrode is used. As a result of the tests which have been conducted, and from the experience of others in electric-arc welding, it is believed that the carbon-electrode process is not suited for general work, some of the reasons being that much greater difficulty is experienced in maintaining the proper temperature, and there are more chances of getting an excess of carbon in the weld.

In the Slavinoff process, which is nearly universally employed at present, it is necessary to have the metal electrodes of such material that the deposited metal in the weld shall have practically the same characteristics as the rest of the metal of the object worked on. As certain of the constituents of the electrode are partially lost in the arc, it is usually necessary to have the electrode contain an excess of certain materials over what is desired in the finished weld. The amount of the loss of these constituents depends upon the temperature, and it is necessary in order to obtain desired and consistent characteristics in the finished weld to have a constant temperature at the weld. The steel companies will guarantee the results with the electrodes which they supply, only if the system of arc welding with which they are used can maintain a constant temperature at the weld.

The Operator

A certain amount of skill and experience is required of the operator, no matter what system of electric welding may be used: but some types of outfits require much more skill and closer attention than others, and it is considered essential that the ideal system should require a minimum of experience and only normal mechanical skill. A system which depends primarily on the skill

*From a paper read before the American Society of Naval Architects.

of the operator cannot turn out consistent work and is not suited to all services.

Fixtures

Certain companies claim that a flux is necessary to obtain good results, but in the tests conducted, all sorts of material and in all positions have been welded, and the best results have been obtained from system in which no flux is used. The claims in favor of the flux are that it blankets the weld by forming a gas around the material which prevents oxygen reaching it and thereby prevents oxidation. This has been proven not necessary, by making similar welds first where oxygen was entirely excluded, and then under normal conditions in the air; there being no difference in strength or structure of the weld.

Another claim is that the flux acts as a scavenger to remove impurities from the weld, but it cannot act in this way unless the metal actually boils, and this is a condition which, as previously shown, should be avoided. There are also certain users who believe a flux necessary for overhead work; but, in tests conducted, as good and consistent welds were obtained when welding overhead without a flux as in any other position. It is considered that in a good electrical welding system a flux is not necessary, and is simply an added expense and complication.

Automatic Control

While it is recognized that it is desirable to have as simple an equipment as possible, it is considered necessary to have an automatic control of the input energy to the weld, the reasons for which have been previously mentioned, so that when the proper amount of energy has been determined for a particular job it will remain constant regardless of the varying of the arc length.

A system with fixed resistances depends entirely on the skill of the operator in maintaining his arc length constant and thereby the energy constant. This system gives good results at times, but our tests showed that even with a skilled operator, furnished by the manufacturer, tensile strengths varying as much as 50 per cent. on the same class of material were obtained. It should be possible for the operator to set the current controlled at the desired amount as well as at the panel board; the controller should automatically keep the current approximately at the fixed value. A variation of less than 5 per cent. can be obtained with a well designed equipment.

Cutting

The electric arc has been found suitable for cutting, but a carbon electrode must be used; no automatic-current control is necessary, although a choke coil is advisable to prevent large inrushes of current. The amount of current varies with the size of the material to cut; from 250 to 400 amperes being required for burning off rivet heads and light section plates, while from 500 to 800 ampères may be required on plates 4 inches thick. This is a momentary load, however, and a 300-ampère continuous-duty machine is considered sufficient. It is necessary to cut away the edges of the cut and remove the burnt metal.

Preparation of Material to be Welded

The material to be welded should be cleaned with a scraper or wire brush to remove oxides and prevent forming of slag, and it is also necessary to bevel the edge sufficiently so that the distance from the electrode to bottom of the weld is less than that of the electrode to any other part of the article, so that the arc will not stray. In thick plates, where possible, and especially in castings, it is usual to weld from both sides, and in this case the original material is pointed by beveling on both sides.

Applications of Arc Welding

During the past year the New York Navy Yard has had contract electric welding done on boilers of various ships. Certain defective castings have been welded, blow holes filled in others, and miscellaneous repair work has been done while the various machines were under test. Additional uses are being developed as the advantages of the method became better known. A large saving in cost over other methods of repair have been made on boiler jobs, in addition to a saving in time, notwithstanding the large profit which the outside contractors have made on the jobs. A specific application of arc welding is in the making of high-speed tools, a piece of the tool being made of ordinary steel while high-speed tool steel is used for the cutting edge only. Some of the various applications are as follows:

Building-up of worn wearing parts, pins, rollers, bearings, etc.; welding of plates in lieu of riveting, or where seams are leaking; building up of rivets; building up of stripped gears; repair of cracked castings; making of high-speed tools; filling blow holes.

In manufacturing work: Welding of heads on tanks; welding of tubes in tube sheets; welding of feet and end frames, etc.

Brass, bronzes, and aluminum as well as steel, cast steel, wrought iron and cast iron can be welded, but none of the demonstrators have been able as yet to get very high tensile strength on naval brass.

Electric-arc welding is considered especially applicable for use on shipboard for emergency repairs of all sorts. In this connection it may be noted that the British cruiser Glasgow put into Rio de Janeiro after the battle off Chile with several holes below or near the water line, and was able, with the arc-welding set which happened to be in Rio de Janeiro, to weld plates over the holes inside of 24 hours and put to sea, taking with her the arc-welding set.

STEADY RESTS

By H. W. Dunbar.

WAY back in the early development of grinding, perhaps 25 or 30 years ago, when very light, narrow faced wheels were used and work was ground by polishing off the surface with very light cuts, no water was used to cool the work and steadyrests were unknown. Trouble arose on a particular job which was about 7 in. or 8 in. long and perhaps 5-16 in. in diameter, because the vibrations in this piece caused the wheel to make marks parallel to the axis of the work. These marks were considered imperfections, and they were imperfections because they could not be seen with the naked eye or without lapping the work in a hole, and seen prominently a great distance away. To these little marks were given the name of "chatters."

For a while they were overcome by changing wheels, getting different bond, different combination of grain and grade, or a different diameter of wheel which caused a different speed and a different cutting action, but this was a long and tedious operation; perhaps a number of wheels would have to be tried before a correct one would be found.

Origin of the Steadyrest

The parts being ground were needle bars used in sewing machines. They moved up and down many times a minute in the head of the machine. This rubbing naturally made these chatters more pronounced and it was very desirable to get rid of them; so a series of experiments was started by which it was hoped to eliminate this imperfection in the work. Among other experiments a spring which had a slight tension in it was placed on the revolving work. The spring was faced with leather where it rested on the work, the object being to absorb some of the vibrations in the work being ground, which it did, and with this the chatter marks were eliminated.

This was the origin of the first steadyrest as applied to grinding machines. The spring was very light and very simple in its construction, as is illustrated by Fig. 1. For a while but one of these springs was used; then one by one others were added until sometimes the entire length of the work was covered by a number of these little spring steadyrests. This gave

origin to the thought that the work while being ground must be steady to keep it from vibrating, for vibrations then were a source of trouble as everything was light, grinding not having developed to the point where it was looked upon as a commercial manufacturing operation where part after part must be ground, duplicating size with good finish, and all this in a reasonable time.

Steadyrest Development

As production increased and a variety of work required steadyresting, a rest was developed similar to that shown in diagrammatic

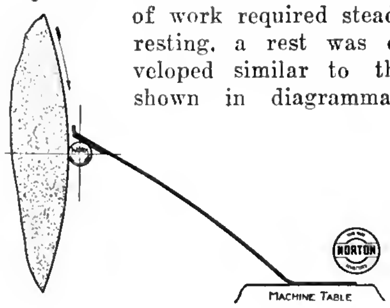


FIG. 1.

form in Fig. 2. This rest was more or less of a rigid construction; the floating shoe which rested against the work was contained in a casting and usually this form of rest travelled with the wheel and always stayed opposite the latter. As a matter of fact this rest has lived through the developments in the grinding industry and is used now by some grinding machine manufacturers for certain kinds of work. Usually, as above stated, this rest travelled with the wheel, but sometimes it was used as a fixture on the table and remained in this fixed location.

It was always felt back in the early days of the development of grinding that to steady the work it was necessary to have a spring rest which would yield as the work being ground happened to be out of line or out of truth. When it was suggested that a solid, rigid, fixed rest would grind round work, the person who advanced the thought was ridiculed, but

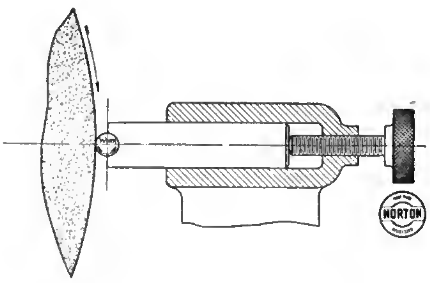


FIG. 2.

being of a determined nature and having a disposition which would not admit of defeat, the person in question developed and designed a rest as illustrated in Fig. 3. This simply shows the principles of the construction and, with his usual care and forethought, he so designed the rest that it could be of a spring type or of a rigid type by simply tightening down on the nuts and taking all of the tension out of the springs provided for this purpose.

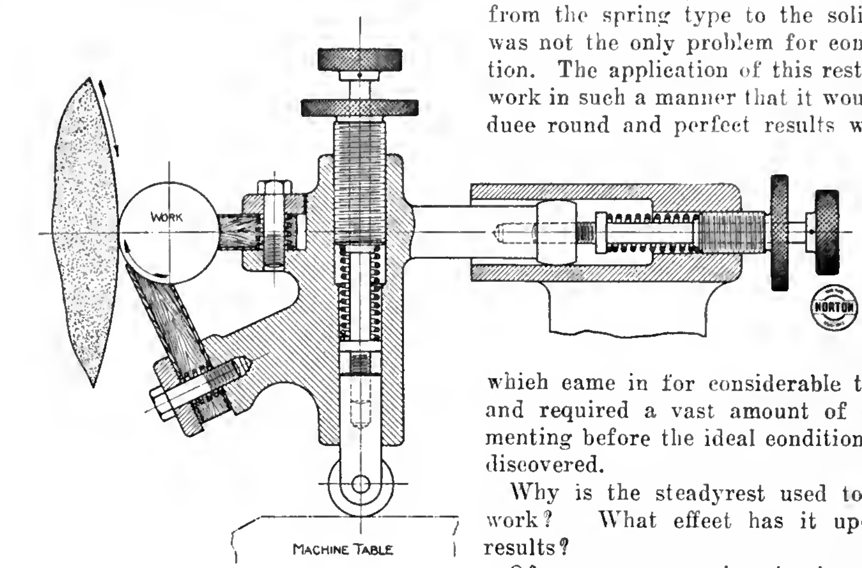


FIG. 3.

With this, round work, better work and more work was ground.

It gave way to a desire on the part of the inventor to produce a heavy type of rigid rest to be used with the heavy manufacturing grinding machine, then in its infancy, with which could be produced quantities of work perfectly round and with perfect finish. Such a machine was developed which did produce more work, and with it came the return of the old chatters. Coarser wheels were used, many work speed changes were provided, and rigid rests, illustrated in diagrammatic form by Fig. 4, were design-

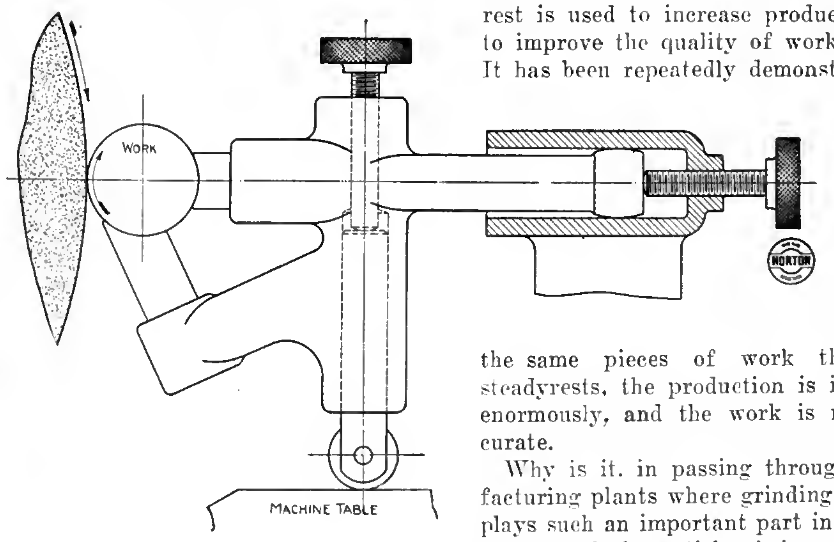


FIG. 4.

ed, which overcame the chatters difficulties.

Thus can be traced up to the present time the origin and development of steadyrests for supporting work while grinding, and with this development came increased production, until to-day the grinding operation is looked upon as one to be reckoned with in manufacturing processes.

The development of the steadyrest from the spring type to the solid type was not the only problem for consideration. The application of this rest to the work in such a manner that it would produce round and perfect results was one which came in for considerable thought and required a vast amount of experimenting before the ideal conditions were discovered.

Why is the steadyrest used to grind work? What effect has it upon the results?

Of course, one can imagine in a grinding machine, a long, slim piece of work which is not stiff enough to support itself and maintain a straight line in front of the grinding wheel. In such work the steadyrests are used to support it, to hold the axis of the work in a true line before the grinding wheel, so that it will be ground round. Without the steadyrest it would be impossible to grind such a piece of work.

Steadyrests Increase Production.

On other work which is stiff enough to support its own weight, the steadyrest is used to prevent the work from vibrating, but most important of all, the steadyrest is used to increase production and to improve the quality of work ground. It has been repeatedly demonstrated on the same pieces of work that, with steadyrests, the production is increased enormously, and the work is more accurate.

Why is it, in passing through manufacturing plants where grinding machine plays such an important part in the production of the articles being manufactured, that one sees the steadyrests discarded, lying under the benches, and the operator going along, unconcerned, grinding without them? If they would only realize that by putting them into use their output would be increased, their work could be brought to size more readily, and with all would come the natural reward for increased production

and better quality — more pay to the operator.

The real object of this article is to impress upon the users of grinding machines the importance of using steadyrests on their work and the possibilities in their use by the increased production and better quality, by explaining the principles of use.

Getting Results

Now to produce the best results, how should the steadyrests be applied to the work? Where should the shoes bear to give the best results?

In Figs. 5-10 in diagrammatic form are illustrated different types of shoes used in different types of steadyrests by different grinding machine manufacturers and the principles of their use will be described.

Let us assume to begin with that the shoes are all of the hardened steel type. In Fig. 5 with the V-type or wedge shoe, assuming the work to be irregular in shape (and all work is more or less this way as it comes to the grinding machine

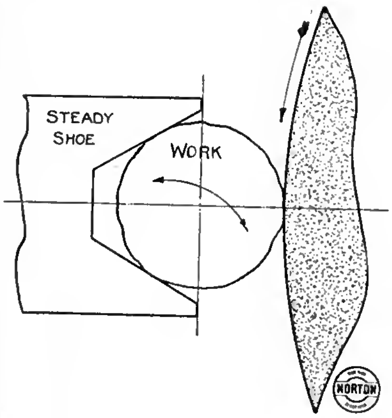


FIG. 5.

—that is why we grind it), we have exaggerated these irregularities by showing the work by a wavy line. Apply the shoe as shown in Fig. 5, and what is the result as the work revolves? When the little low spots or high spots come to the point of contact on the lower side of the wedge, naturally the work changes its position and drops or rises as the case may be. A corresponding change in position takes place when these same spots touch the upper part of the wedge in the steady shoe.

With the work rising and falling in this manner, caused by its own revolution, it naturally follows that the same motion takes place at the point where the work meets the grinding wheel and if you were to continue to grind forever, this work could never be ground round. When we say round we mean round to the point of commercial perfection, within a variation of say .0001 inch. Put the micrometer on the work at different points around its diameter and you will find a variation in roundness, the only improvement being in the finish.

The arrows indicated on the work show

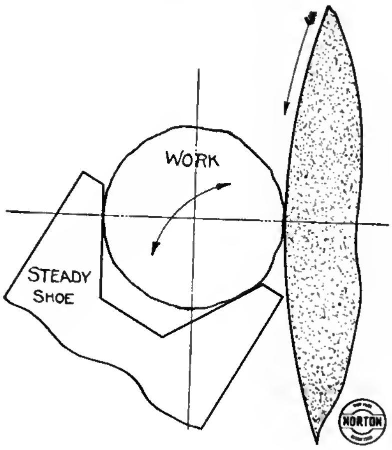


FIG. 6.

approximately the path that the work takes as it goes through this change in position, the motion being generally in the direction of the rise and fall, and determined by the point of contact on the shoe, which forms the fulcrum for it to swing upon.

In Fig. 6 we have simply changed the support with the thought that perhaps the weight of the work would be downward and the support must necessarily be underneath. The conditions, however, have not been changed. The irregularities in the work cause the same motion, but in a different direction, as illustrated by the arrows on the work.

In Fig. 7 we have assumed that the work is stiff enough to support itself, and have simply added a steady shoe diametrically opposite the wheel, with the thought of takin gthe thrust of the wheel or the pressure as it is grinding. Still the same phenomenon exists, and the irregularities in the work allow it to go and come between the wheel rise and fall, and the work cannot be ground round.

To prevent the work dropping (in Fig. 8), a shoe has been placed on two dia-

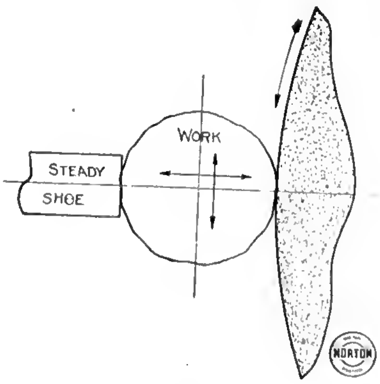


FIG. 7.

meters of the work—one the horizontal centre line, and one the vertical centre line. Still the work cannot be ground round. The little high and low spots still get in their bad work and the wheel follows the movement of the work and continues to keep it out of line.

Fig. 9 is a common shoe used in twist drill grinding. It is evident that the same law is at work, and the same results will be brought about.

Fig. 10, however, illustrates the only correct way of applying a steadyrest shoe to the work. It takes the form of a saddle. Here the arcs are long enough to span over the irregularities in the circumference of the work, and support it

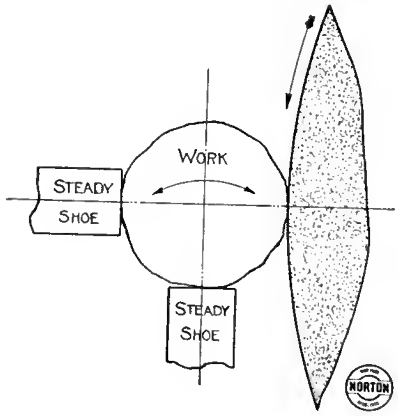


FIG. 8.

in its rotation, keeping its axis in a straight line all of the time, and the correct relation to the wheel, so that eventually the high spots are ground off, and the round, true work seats itself in

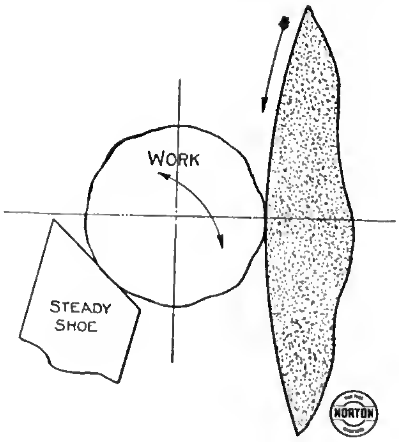


FIG. 9.

the shoe. The shoe generally is of the finished diameter of the work, so that it forms an accurate bearing for the finish cut.

One arc or saddle must be diametrically opposite the wheel to take the thrust of the wheel in that direction. The other saddle must be brought up as near as possible to the point of grinding, and on the opposite side of the vertical centre line to the first mentioned saddle. This takes the thrust of the wheel in its direction of rotation. If this arc is not positioned as described, but is placed even on the vertical centre line, the wheel

seems to draw the work in towards it and pinches and wedges it between wheel and shoes, so naturally the work will not come out round.

Steadyfast Shoe Materials

We see a number of different kinds of

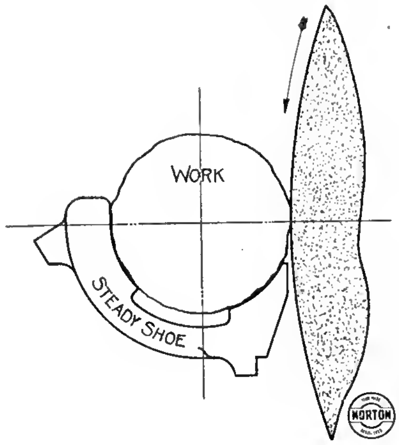


FIG. 10.

material used for steadyrest shoes, and the question is asked: "What are the virtues or what are the reasons for different kinds of material?"

We have, for instance, wooden shoes, bronze shoes, or hardened steel shoes, all

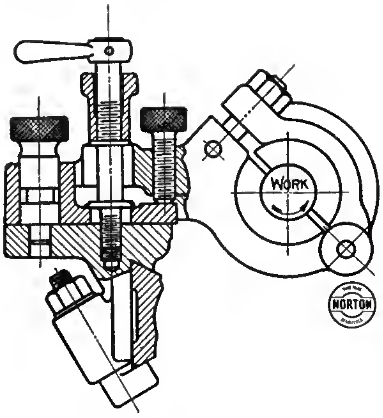


FIG. 11.

of which are equally good for producing correct work, but the hardened steel shoe has a decided advantage over the other types of shoes which are made of softer material and is always used where piece

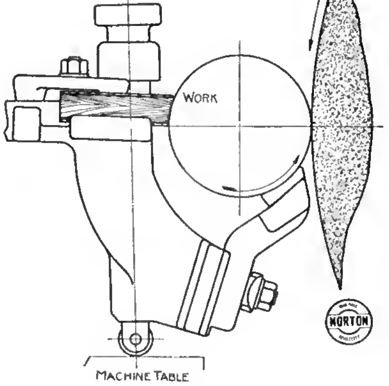


FIG. 12.

after piece must be produced, without thought or care on the part of the operator, to a given diameter and dimension. It naturally follows that a hardened steel shoe would serve best for this purpose because it does not wear so rapidly. With the softer materials, the wood or the bronze, the wear takes place very rapidly, and constant adjustments must be made to produce a duplication of parts to the same dimension.

Where the work is heavy and needs

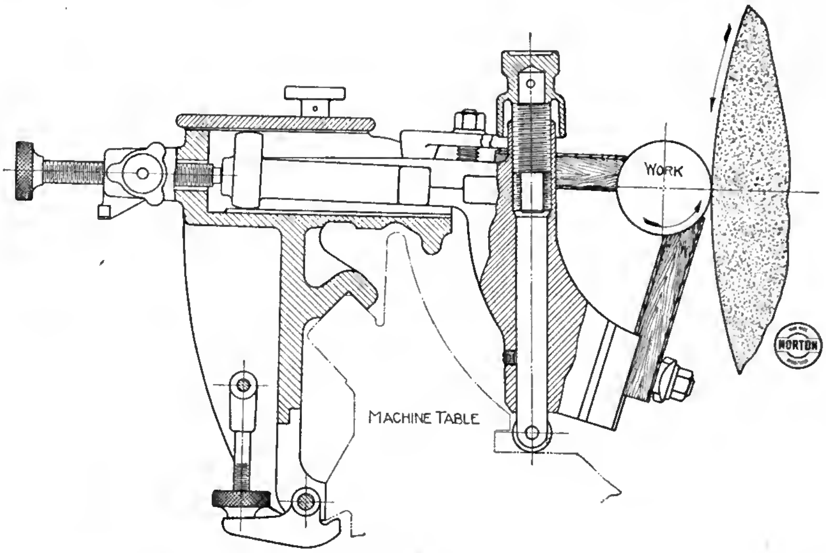


FIG. 13.

but little support, simply something to prevent vibrations, steadyrests with wooden shoes give good results, but it must always be borne in mind that where the shoes rest on the work, whether they be of wood, bronze or hardened steel, they must form an arc or saddle to span over a considerable amount of the cir-

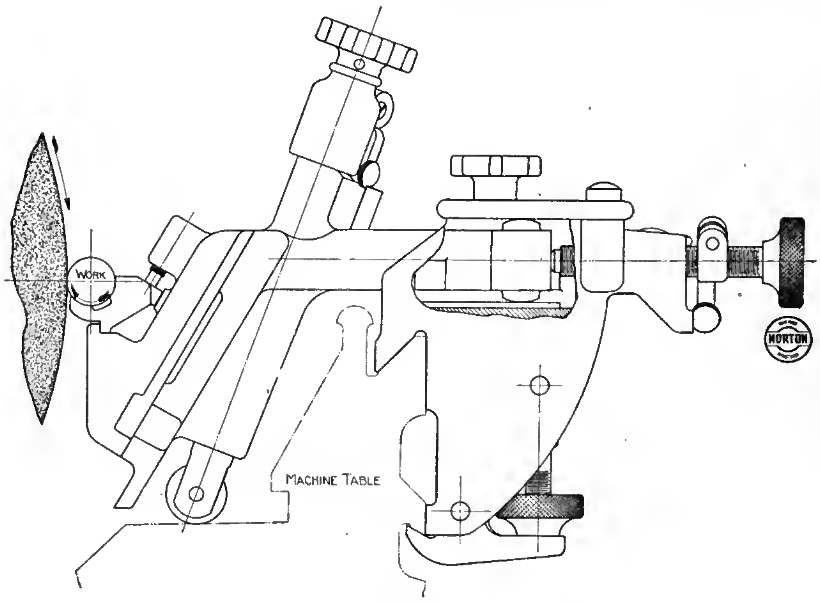


FIG. 14.

cumference of the work and act much in the same manner as would be the case were you holding the work up against the wheel with your hands, resting it in the palms.

It has always been felt that hardened steel shoes marred the work, but experience shows this is not true. Hardened steel shoes mar the work less than wooden shoes or bronze shoes, for the reason that, to begin with, they are polished out smooth and true, and the very fact that they are hard will not permit them to hold dirt or grit with which the work could be marred, whereas, on the other hand, the softer materials will naturally collect the dirt and grit and scratch or mar the work where they bear on it.

Steadyrest Types

Different types of steadyrests which are used successfully are illustrated in Figs. 11-14. Fig. 11 is the enclosed type of steadyrest and is used principally in grinding camshafts. Of course, with this closed type of steadyrest goes a longer time for removing or putting in the work, but, where exceptionally nice work is required, extra precautions must be used to bring about such results. Here the

work has much the same action as it does in the mechanism it is to be used with. The steadyrests form the bearings that the part being ground revolves in. They cannot be used, however, at the point where the work is being ground and must be placed at a point previously ground.

Figs. 12 and 13 are the common, plain-type wood shoe rests, Fig. 12 being adapted to large diameter work with an extension shoe.

Fig. 14 is a steadyrest carrying the hardened steel work shoe. The design, application and use are self-explanatory.

Just a word of caution. Too many steadyrests cannot be used. It is very easy to get too few. Even though there be no advantage in more steadyrests than necessary, there can be no harm. No rules can be laid down, no laws applied by which one can decide on the exact number of steadyrests necessary to support or steady work while grinding. Experience alone can be the only means of determining this question. Put on as many steadyrests as are necessary to support the work, to grind it round and true and to the desired finish.

Where duplication of work to a given dimension is desired, use the hardened steel work shoes and whatever type of shoe is used, always be certain that one support is diametrically opposite the wheel and the other is on the opposite side of the vertical centre line, as close up to the point of contact between the work and wheel as is possible to get it,

THE WORK PROPERLY SUPPORTED.

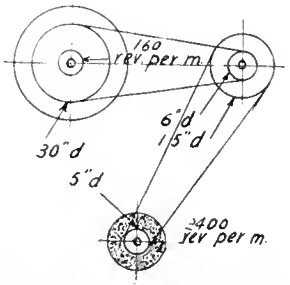
and further, be sure that where these shoes bear on the work they form arcs or saddles which span over a considerable part of the circumference of the work.

It may seem a hardship, and it may be considered unnecessary by some to use steadyrests, but, if you wish to increase production and get all that is possible out of the machine in the way of a number of parts an hour or day to a degree of accuracy and finish which borders on perfection, use steadyrests.

We are indebted to the Norton Grinding Co. for the data and cuts.

Questions and Answers

Question.—We have an emery wheel which calls for a speed of 2,400 revs. per minute. The pulley on the machine is 5 in. in diameter, and the counter-shaft has pulleys of 15 in. and 6 in. What size pulley must we use on the line-shaft which revolves at 160 revs. per minute?—J. H.



SPEED OF EMERY WHEEL.

Answer.—The speed of the line-shaft multiplied by the diameters of all the driving pulleys must equal the speed of emery wheel shaft multiplied by all the driven shafts.

Let x represent the required quantity, or diameter of pulley on line-shaft: then $160 \times x \times 15$ must equal $2400 \times 6 \times 5$, or to find the value of x, we have

$$x = \frac{2400 \times 6 \times 5}{160 \times 15} = 30 \text{ in., diameter of}$$

pulley necessary to put on line-shaft.

It would possibly be better to use a little larger pulley on the counter-shaft and a little smaller on the line-shaft.

* * *

Question.—Is there any material difference between an arbor and a mandrel?—P. E. T.

Answer.—Generally speaking, a mandrel is employed for holding work to be turned, while an arbor is a shaft for holding cutters, saws, etc., such as is used on millers, saws and similar machines.

* * *

Question.—We have several small tanks to construct which are to contain 30 gallons. They must go into a space of 18 by 20 inches; what must be their heaight?—A. B. C.

Answer.—As there are 277.25 cubic inches in one Imperial gallon, the tanks will have a volume of $277.25 \times 30 = 8317.5$ cu. in. As the tank must rest in a space of 18 x 20 inches, the area of base will be 360 sq. in. The height will therefore equal the volume divided by the base, or $8317.5 \div 360 = 23\frac{1}{8}$ inches high, nearly.

Question.—(a)—When two pipes, of 8 inches diameter and 12 inches diameter respectively, join into one, what must be the diameter of the main pipe to retain the same volume per running foot as the two smaller pipes?

(b)—Is there any general rule that can be employed for the solution of this and similar problems?—L. M. K.

Answer.—(a)—The area of the 8-in. pipe would be $d^2 \times .7854 = 8 \times 8 \times .7854 = 50.2656$ sq. in.

Area of 12-inch pipe $= d^2 \times .7854 = 12 \times 12.7854 = 113.0976$ sq. in.

Area of main pipe will be $50.2656 + 113.0976 = 163.3632$ sq. in.

$$\text{Diameter of main pipe} = d = \sqrt{\frac{A}{.7854}} = \sqrt{208} = 14.422 \text{ inches.}$$

(b)—The areas of squares or circles vary as the square of their sides or diameter; thus, a square whose side is 12 inches is 4 times as large as one whose side is 6 inches; see Fig. 1. This rule applies to the circle as seen in Fig. 2, where a circle of 12 in. is shown to be 16 times as large in area as a 3-in. circle. The area of the 12-in. circle $= 12 \times 12 \times .7854 = 113.0976$ sq. in., and that of 3-in. circle $= 3 \times 3 \times .7854 = 7.0686$ sq. in. The content of the former, 113.0976 divided by 7.0686, the content of the latter = 16.

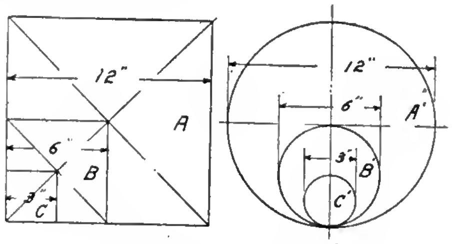


FIG. 1. FIG. 2.
PIPE VOLUMES.

As problems of this nature are usually solved by the right triangular method, where the square of the hypotenuse equals the sum of the squares of the two sides, a very convenient method and fairly accurate is that which uses the ordinary carpenter's two-foot square, and shown in Fig. 3. The diameter of one pipe is laid off on the butt and the diameter of the other on the blade. The

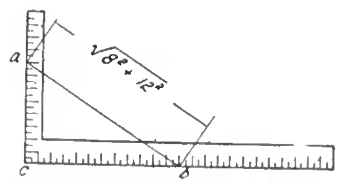


FIG. 3. PIPE VOLUMES.

distance from one extreme to the other, as a—b, will equal the diameter of the main pipe, which will have the same area as the two larger pipes. If three pipes are required to run into one, this prin-

ciple can be extended by taking the length a—b and using it as one diameter, and the third pipe diameter (b—d) as the two sides of another right triangle; the hypotenuse (a—d) will then equal the diameter of pipe required, Fig. 4. This method can be extended for any number of pipes.

* * *

Question.—When shrinking on several small iron collars some time ago we had trouble in keeping them tight, or due to them breaking. Is there any method

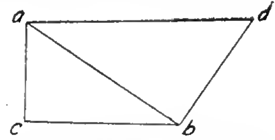


FIG. 4. PIPE VOLUMES.

whereby we might overcome these occurrences?—H. E.

Answer.—If the collars are small in diameter in relation to the shaft, it might be advisable to turn them from the solid, but, if this cannot be done, you might try knurling or scoring the shaft where the collar is to be fitted. By this means, the collar in shrinking will be forced into the impressions made by the knurl, and prevent it from slipping or coming loose.

GIRL WORKERS IN MUNITIONS' FACTORIES

THE rapidity with which the Minister of Munitions has organized numerous local arsenals in Britain has accentuated the shortage of skilled labor caused by the mistake made in allowing large numbers of skilled artisans to join the colors in line regiments, where their individual efforts could not have such far-reaching effect on the progress of the war as if they had remained at home to make the shells and fuses.

For some time women workers have been employed in a few engineering factories engaged in shell making, the first attempts being largely in the nature of experiment. The results of these efforts have been so successful that the entrance of women into this field of patriotic effort is increasing rapidly.

Those who are familiar with the general capabilities of machine tools are quite astonished at the results already accomplished, according to a report in "The Engineer." The girls employed were entirely new to the work, but so great was their enthusiasm that they soon became adepts in operating the various machines. Not only have they become skilful enough to produce work true to gauge, but the average output is quite high.

In a recent visit to the Glasgow factories organized by Sir William Beardmore, an opportunity was afforded of observing the conditions and work. About 800 girls are at present employed in these plants, the particular plant visited employing over 300 alone.

Girls Develop Skill

Along with these 300 girls are 60 men who are employed in tool-making, setting up machines, laboring, tightening up base-plates, and other work which requires considerable strength rather than skill. Some of the girls have now been at work for about four months, and were first trained by special instructors selected from men employed in other departments of Messrs. Beardmore's works, assisted by skilled operators sent by the makers of the machines, and after only a few weeks' instruction were found capable of a good output on many operations.

Every encouragement is offered to them, and the greatest attention is paid to their health and comfort. Lady superintendents are in charge of the place day and night to look after the girls, a good mess-room is provided for their meals, and a 15-minute interval for tea is allowed during the afternoon. The result is an extraordinary appearance of keenness and contentment, and whether done by day or night, the work is just as good and just as speedy.

The girls will not admit that the work is too heavy for them and one cannot but admire the manner in which they handle 4.5-in. shell bodies without mechanical appliances or assistance from the laborers provided by the company.

TORONTO HARBOR DEVELOPMENT

OVER two million dollars has been spent on the harbor improvement work this and last year. The great development plan, including sea wall, boulevard, parks and industrial areas, which will take until 1921 to complete, although interrupted this year by the discovery of defects in the Government work, has been going ahead apace. The Harbor Commission has not let up in its part of the work, and a great area has been reclaimed by the dredges. About 200 acres of land, valued at $10,000 an acre, has been made in the industrial district, a total value of $2,000,000, which cost $450,000.

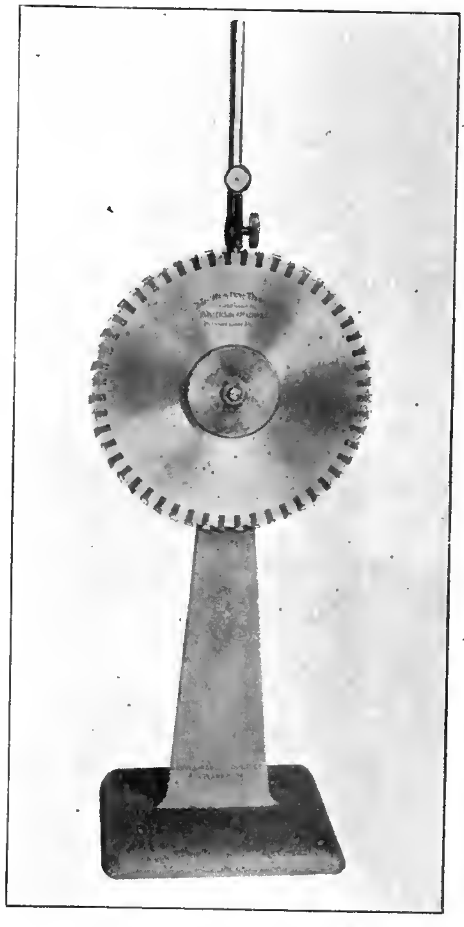
Making Land

Two big dredges are now operating, one in the Ashbridge's Bay district, the other in the west end near the Humber, and since spring they have pumped 2,200,000 yards of material. Clam-shell dredges are working in the vicinity of Leslie street, throwing up large earthen dykes to retain the filling. Twenty-five acres have been made in the west since the spring, and between 75 and 100 acres in the east. At Ward's Island, 15 acres of park land has been made for the city. No crib-work has been done this year.

The special commission appointed by the Government to inspect the Government work which was found defective is still on the job, and has eight divers engaged. The Canadian Stewart Co. have been given 100-foot sections to shown what they can do to make good the work about which complaint was made. The repair work will take considerable time, and a year's delay is the consequence.

SETTING DEVICE FOR INSERTED TOOTH SAWS

TO enable the teeth of inserted tooth saw blades to be set accurately to the proper height and thus all do their proportionate share of the work, the Hunter Saw & Machine Co., Pittsburgh, Pa., has placed a special device on the market. It has a cast iron base into which is fitted a cold-rolled steel bar. A graduated indicator slides up and down along the bar and is adjusted to permit blades up to a maximum diameter of 76 in. to be assembled rapidly and correctly. In connection with the device the proper size of arbor is furnished to fit blades from 12 to 76 in. in diameter.



SETTING DEVICE FOR INSESRTED TOOTH SAWS.

Accuracy in the setting is taken out of the hands of the mechanic and left to the indicator at the top of the blade, which indicator registers to 0.001 in.

CONTEMPORARY WAR ARTICLES

Embracing Information and Data Drawn from a Variety of Sources Relative to and Arising from the Prosecution of this Many-Sided European War

MODERN MUNITIONS OF WAR

IN the third and last of his lectures on the subject "Modern Munitions of War," at the Royal Society of Arts, on Wednesday, Professor V. B. Lewis discussed poison gases and bombs. Gases, he said, could be divided into three clases. In the first class were those which produced death, but had no poisonous effect. They killed by merely cutting off the oxygen supply necessary for life. Carbon, dioxide, nitrogen, and hydrogen were gases of this character, and were what might be termed suffocating gases.

In the second class were the true poison gases, which included carbon monoxide, cyanogen, and several others, 1 per cent. of which in the atmosphere would rapidly prove fatal. They were purely toxic in action and nothing else.

The third class consisted of asphyxiating gases, and included sulphur, dioxide, chlorine, some oxides of nitrogen, and that curious gas called phosgene. These had an effect upon the respiratory organs which produced spasms in the throat and set up such virulent inflammation of the respiratory organs that death ensued. It was these latter gases, or some of them, that the Germans had undoubtedly been using.

Poisonous Gases in Warfare.

As a matter of fact, continued Professor Lewis, it was not an easy thing to use a poison gas in warfare. Many people supposed that carbon monoxide was used as a poison gas in warfare, but a little consideration showed the fallacy of this idea. As a matter of fact, more carbon monoxide had been produced by the ordinary propellants used by ourselves and our enemies than we could have made had we set out to make this gas. The shells used in the 15-in. guns on our super-dreadnoughts, which contained 400 lbs. of cordite, gave, roughly, 2,500 cubic feet of carbon monoxide, and the gas was given off in every form of explosive used. Nevertheless, not one death could be directly traced to carbon monoxide, with the exception that during the sieges of Liege and Namur there were one or two cases of death in forts where the shells had penetrated before they burst.

The reason of the immunity was the wonderful power of gases of diffusing and intermingling against the force of gravity. Professor Lewes showed two experiments demonstrating this, and proving Graham's well-known law that gases intermingle at a rate which is inversely proportional to the square root of their density. In order, therefore, to obtain an asphyxiating gas which would not diffuse before it reached the opposite trenches under the influence of light air currents it was necessary to have one much heavier than air. For a gas to travel in a light air current it must be at least double the weight of atmospheric air. This limited the gases which could be employed, i.e., asphyxiating gases, to the following:—

	Density	Times heavier than air
Sulphur dioxide	32	2.21
Nitrogen tetroxide	46	3.17
Chlorine	35.5	2.46
Bromine vapor	80	5.36
Phosgene	50.6	3.49

Asphyxiating Gas Production—Sulphur Di-oxide.

Professor Lewes had samples of these gases on the lecture table and explained briefly the manner in which they are made. Sulphur dioxide was one of the earliest gases thought of for use in warfare. It is nearly one hundred years ago that an ancestor of the present Earl of Dundonald suggested the use of large stacks of easily burnable material which would give off great volumes of smoke which were to be fed by sulphur. These were to be built to the windward of the enemy, so that the smoke blew towards him, and under cover of the smoke an attack could be made.

The British Government at once declined to have anything whatever to do with the scheme; it had been suggested again and again at various intervals, but on each occasion it had been turned down with abhorrence. At the beginning of the present war it was again suggested and again declined. Sulphur dioxide, converted into a liquid state, was being used by the enemy in hand grenades, and with it were used a number of volatile substances of a disagreeable and poisonous character to give a little extra "bite" to the sulphur dioxide. As a gas, however, it was comparatively harmless, because if one could escape from the neighborhood it would be found that the effects passed away after a time and there was no lasting injury.

Chlorine Gas.

The second in the list—chlorine—was undoubtedly used by the Germans to the largest extent. This was made simply and readily by heating a mixture of hydrochloric acid and black oxide of manganese. It was a yellow gas and 0.04 per cent. mixed with the air made the surrounding atmosphere irrespirable and its effect upon the lung tissue was such that, inhaled in anything like large quantities, there was practically no recovery from it.

Chlorine is made in large quantities electrolytically at several large chemical works in the neighborhool of Widnes, and can be made into a bleaching powder or condensed into a liquid state and bottled in steel cylinders lined with lead. In Germany enormous quantities were made and bottled in this way, and it had been used in South Africa and other places for the treatment of gold residues, i.e., for treatment of some of the poorer slags, and now this gas was largely used in the war by the Germans.

The use, however, of chlorine gas in this way under such great pressure is not entirely without trouble, because when such a liquefied gas is liberated and once more assumes a gaseous form there is such an enormous amount of heat absorbed that the surrounding conditions are made most uncomfortably cold. This was demonstrated by experiment. Thus, say, there were a dozen cylinders of gas in the enemy's trenches, it will be seen that so intense would be the cold produced on liberation of the gas that trouble would be experienced with the chlorine freezing in the tubes along the trenches. The result was the necessity for driving the gas out into a chamber sufficiently large to prevent cooling down to the point at which the chlorine would solidify, or else to blow the chlorine into a heated coil or tube which would do away with the absorption of heat.

It had been reported—he was not sure with what truth—that the enemy had at times placed pipes some 10 feet or 12 feet in advance of his trenches, fitted with valves connected with gasometers and a chlorine manufacturing plant in a wood or other convenient spot a short distance away. Then the gas had to be merely turned on and there was not the trouble of cooling through the change of state. With this gas there was such a corrosion of the lungs as to cause very rapid dilation of the heart, which proved fatal after a short space of time even if the victim were rescued from the position he was in.

Other Gases.

Another gas which the Germans were credited with using was bromine vapor. Bromine vapor was of a reddish-brown color, but as a marked feature of the German gas attacks had been the yellowish color of the cloud of gas, it was probable that in almost every case the gas

used was chlorine, or bromine vapor very much diluted.

Nitrogen tetroxide, one of the oxides of nitrogen, was another reddish-brown gas and also had a serious effect upon the lungs. The first effect was similar to chlorine, producing an acute form of bronchitis. A man might appear to be getting over the effects, but after he had apparently recovered he would have a sudden collapse and die, due to erosion of the lungs and air passages. There was not the least doubt in his mind, said Professor Lewes, that chlorine and sulphur dioxide were the gases the Germans were using; all the symptoms pointed to them, there being an absence of the deep yellow staining which would accompany the other gases in the list given above.

After briefly referring to respirators and recommending, as the most efficacious, a strip of flannel or cotton rag, soaked in ordinary washing soda, Prof. Lewes said it was an open question question as to whether we should retaliate. Many people believed we should, and if he thought we could thereby save one of our men he would be as strongly in favor of this as anyone. The Germans, however, expected retaliation and were prepared to the utmost for it. Nothing we could do would surprise them, and under these conditions it was far better, in his opinion, to keep our hands clean and fight that straight fight that had always pulled us through.

Bombs.

In conclusion, Professor Lewes drew attention to the difference between British and German bombs. There was not, he said, the slightest doubt of the superiority of English bombs over the foreign variety. Samples of the 10 lb. and 20 lb. bomb carried by aeroplanes were on view, and it was explained how for the destruction of life these were filled with 4 lb. of T.N.T., and shrapnel bullets, whilst for incendiary purposes the charge consisted of about 8 lb. of T.N.T. alone. The functions of the two sets of vanes were described, the fixed vanes being for the purpose of giving a perfectly straight downward path to the bomb, and the top revolving vane having for its object the setting into motion of the firing mechanism. Before releasing the bomb a safety pin is removed, which allows the revolving vane to move. Thus in ordinary handling there is complete safety, the firing mechanism not being in a position to operate until the small vane has revolved four and a-half times.

The British incendiary bombs Professor Lewes would not describe, "because they differ in construction from those of the enemy." As to the German bombs, two specimens, or rather remains, were shown of bombs dropped during the earliest East Coast raids. One was picked up at Braintree by two soldiers, who dropped it into a bucket of water, and in this connection it is interesting to note that the authorities state there has not yet been one incendiary bomb dropped here that could not be put out by a few buckets of water. Both bombs showed very rough workmanship mechanically, and seemed to indicate, as Professor Lewes said, that the Germans thought that any old thing would do. Their contents were a winding of tarred rope round a rough frame, inside which were a quantity of resinous bodies, and in the centre a heating charge of thermit, and below a tray containing amorphous phosphorus. The other relic of a bomb was obtained from the recent London raid and was of a similar character, although slightly different in shape from the Braintree sample.

Amorphous Phosphorus.

Amorphous phosphorus, continued the lecturer, seemed to be playing a rather important part at the front and was causing us some trouble. At a temperature of over 300 deg. amorphous phosphorus was converted into ordinary phosphorus and at once caught fire. The Germans were using this in shrapnel shells for marking the range at night. If a man was wounded by a piece of such a shrapnel phosphorus poisoning and complications were set up which were extremely difficult to get over. The Germans could secure their object by the use of harmless substances, but the devilry in their nature made them employ substances of this character, which caused intense suffering.

We are indebted to The Engineer for the foregoing abstract.

INSTRUMENTS USED ON AEROPLANES.

THE various instruments in use on aeroplanes would puzzle those who are not familiar with the work, says The Times, London, England. Nominally they are ordinary enough, but they must possess in many cases peculiarities of considerable importance. The list includes:—

1—Engine speed indicator.
2—Air speed indicator.
3—Horizontal (transverse) level indicator.
4—Gasoline gauge.
5—Aneroid graduated in feet height.
6—Oil gauge.
7—Aeroplane compass.

In addition to these are the bomb sight, the bomb release mechanism on some aeroplanes and in some the wireless equipment, none of which is it timely to discuss just now.

Engine Speed Indicator.

The engine-speed indicator being the rough gauge by which it is ascertained that the engine is pulling properly—since it is coupled to the approximately constant load of the air screw—must not only, like all aircraft instruments, be exceedingly light, but must possess an accuracy very much in excess of that of the more ordinary motor car speed indicator. For example, a 3 per cent. error arising without warning would be a grave matter.

If an engine intended to run at 1,150 revolutions per minute were, in fact, to be running only at 1,120 revolutions per minute, when the speed indicator declared 1,150, this would induce the attendants to suppose that the propeller was getting distorted and giving insufficient thrust. The result would be the delaying process of changing propellers.

Now, the mere moving about of the flexible driving shaft will often be found to make 3 per cent. difference in roughly constructed speed indicators. Another fault which is found is that of giving a speed reading when speed is rising different from that given when it is falling. This lag may in the extreme case endanger a pilot, apart from leading, as in the previous case, to unnecessary waste of time, owing to misleading information about the state of the engine.

It is not always recognized that when the instrument is exposed to the vibrations of an aeroplane, the readings are often different from those obtained in steady test. The test should, therefore, be made in such a way that moderate vibration can be applied. On a motor car a continual swing of the needle from say 23 to 26 miles per hour would be no grave defect, but in the air such a swing covers the percentage range of variation which is tolerable and, therefore, the reading is certainly not dead beat enough.

The problem is a difficult one, partly, because of the high engine speed used, in many cases up to 1,800 and 2,000 revolutions per minute—a very widely different matter from the road wheel speeds of cars—and partly because of the much greater importance attachable to the result; its solution, however, has been remarkably well obtained.

Level Indicator.

The level indicator is not always carried, and when carried is not always transverse as it should be. It is usually a small arched spirit level. The objection to carrying such a level fore and aft is that the readings are rendered even more fictitious and misleading in this position by the acceleration of the aeroplane. When the machine is flying dead level a fore-and-aft instrument will indicate a substantial gradient if the aeroplane be accelerated or retarded. In this position, therefore, it should be abandoned. When it is placed trans-

versely there are errors due to side gusts, but these are very much smaller and cannot lead to that great bugbear of the flyer, "stalling" the machine.

The purpose of the transverse spirit level is in part fulfilled by Mr. Ogilvie's floating "bit of string" hung clear of the intake or slip stream of the tractor air-screw, because any continuous banking without turning involves yawing, and therefore a side wind strikes the string. Were the string easily set clear of propeller disturbances and its indications more easily visible within the pilot's enclosure, especially at dusk, its universal use would be assured. It scarcely seems necessary to mention that the transverse spirit level shows "level" however steeply the aeroplane be banked, provided the bank is the dynamically correct one for the radius and speed of the turn.

The gasoline gauges for both level and pressure are by no means to be overlooked among the important, and indeed essential instruments on an aeroplane. Moreover, their installation offers several difficulties so considerable that they are not imperfectly met.

Regulating the Gasoline.

The volume of gasoline is so large nowadays that the use of a gravity flow as sole supply is practically out of the question (in view of the respective levels of carbureter and fuselage). The pressure feed tanks are often under the seat of the passenger, and as a loss of pressure must not result in a forced landing without plenty of warning, it is becoming universal to use a gravity supply of fuel from an auxiliary tank placed high up and containing one hour's supply or more. This tank is kept always full by permanent pressure on the main tanks.

The pilot wants to know this pressure, and a gauge for this is fitted. He wants to be certain that he is not over-pumping, else he merely forces gasoline to waste through the overflow from the top or gravity tank. The gravity tank must have access to the open air by this overflow pipe, otherwise fuel will not be supplied under gravity on just the very emergency arising from the loss of tank pressure. The fuel overflow from the upper or gravity tank might be made to advertise itself, but for the fact that it will blow back into the face of the pilot and temporarily blind him. This means a fuel level gauge in the upper tank.

All gauge glasses, reflex and others, are hard to read from the distances usual in practice owing to the white color or the liquid, and poor light at dusk, and other reasons. All dial gauges at present made involve complications, and are not usually fitted with mechanism for transmitting the information to the pilot cab. The main tank level gauge being under pressure is subject to the same difficulties. There are pneumatic transmission devices, which mostly suffer from grave errors due to the expansion of the enclosed air, with temperature or with the very large and rapid changes of altitude of an aeroplane. Moreover, all pipe work on aeroplanes has been proved difficult to maintain intact in view of vibration and distortion of the machine generally both in the air and by the shock of landing.

The Aneroid.

The aneroid is one of the instruments which has been perfected to a very remarkable degree by the advent of flying. Three years ago there existed no aneroid which did not suffer from the serious defect of a violently vibrating index needle, or alternatively of substantial inaccuracy from friction or damping under which the vibrations were masked. Much labor has been expended in getting the support of moving parts situated at the precise centre of gravity of these parts —an alteration which was never needed till an aneroid was required for accurate reading on a vibrating support. The balancing of those portions of the expanding boxes which may be regarded as moving parts is not entirely an easy task, but the solution exists. What does not exist is any means by which the flyer can tell whether the reading of the barometer has changed owing to atmospheric variations during the four or five hours since he left earth. Any error that arises in this way the flyer reads off, unwittingly thinking himself to be higher up or lower down than his real altitude. Here again the physicist may yet come to the rescue, so the problem is posed for his attack.

The Oil Gauge.

Even so small a matter as the oil gauge on the engine's oil circulation requires special care with some aeroplane engines. Thus, if the oil pressure is too high the engine uses an excess of oil and thus reduces the number of hours of air endurance; that is, it may involve a forced landing earlier than expected. Other engines are inclined to cause an excessive pressure at the time of starting, when the oil is cold and highly viscous. The pressure rises so high that the gauge either bursts, or, if it is strong enough to take the high pressure, is insufficiently sensitive to read at the low pressure of normal use with warmed oil.

The aeroplane compass must, after being installed, be swung so as to stimulate by small adjusting magnets the error due to permanent magnetism of steel parts, just as a ship's compass is swung. It must be corrected, if possible, to avoid quadrantal error from the effects of soft iron parts, such as tanks, which may be nearby. It must, far more particularly than a ship's compass, be corrected for the effects of vibration, which cause a very large deviation. It must also be capable of allowing a course to be steered direct north, and no swing should be caused by banking. These corrections will be seen to be substantially different from those required on board ship, and substantially more searching.

Illumination.

Lastly, the illumination of all instruments on aircraft is a peculiar problem. Luminous paint of all kinds is useless, because, however valuable this might be after dark has set in, no luminous paint has sufficient value to act adequately during the twilight, and it is precisely in twilight and not in the dark that the illumination is required. Electric lighting must be very carefully moderated to a minute light, else the contrast between a well-lighted intrument board and the poor light outside blinds the flyer, who, therefore, cannot safely alight or properly distinguish his objective.

STEEL FURNACES' RECORD OUTPUT

THE blast furnaces of the big steel interests made a new tonnage record in August, producing pig iron at the rate of 67,801 gross tons a day, against their previous high record of 64,658 tons a day, made in April, 1913. The production of steel probably represented a still greater gain over the previous record rate, for the reason that, when the previous record pig iron rate was attained, the steel works had been operating substantially at capacity for about eight months, and had undoubtedly consumed all their stocks of pig iron, whereas lately they have still had stocks from which to draw. On account of the filling of so many war orders requiring heavy cropping from the ingot 20 to 40 per cent., the production of steel ingots is doubtless greater, in proportion to pig iron, than ever before.

The merchant blast furnaces produced pig iron in August at the rate of 21,865 tons daily. While the merchant furnace production has been increasing since early in the year, by a total of fully 50 per cent., the August production was 23 per cent. under the previous record, which was 28,364 tons a day, made in February, 1913.

No factory owner of sense would expect one of his machines to run without lubrication, and decent people require the oil of fair treatment and pleasant words to keep them in good running order, as well as a reasonable remuneration.

TESTING THE EFFICIENCY OF LUBRICATION.*

By Alan Flowers.**

THE probability of being able to determine with great exactness the best lubricant for a specified group of conditions, is indicated in a recent paper by Professor Alan Flowers.

The apparatus as now constructed is the result of experiments begun at the University of Missouri in 1909. Fig. 1 is a diagrammatic illustration of the apparatus. It consists of a steam cylinder within which two pistons connected by a piston rod are placed. The space between the two pistons has a constant volume, so that steam admitted to this space does no work on the pistons. Two steam pipes are brought into the cylinder at points just short of the parts rubbed over by the piston, so that oil carried along by the steam may readily reach the rubbed surfaces. An electric motor drives five slots may have rings placed in them. All the rings have a ⅜-in. face and each of the four sets has a different radial thickness, so that the intensity of pressure exerted by the piston-rings against the cylinder wall may have values from 2 to 9 lb. per sq. in. Suitably located thermometers indicate the temperature of the working surfaces. Arrangements were provided so that the outer sides of the pistons could also be subjected to any desired steam pressure. The difference in pressure on the two sides of the piston is an important element in the amount of oil feed necessary and the difference in temperature on either side of a piston, as in condensing engines, is an important element in determining the viscosity of the lubricant, and therefore the amount of friction encountered by the pistons and piston-rings.

Electric heating coils provide a means of testing with various degrees of super- at atmospheric pressure, it takes at least 30 minutes for the friction to change.

Conclusions

The author deals with various features, and amongst other results presents the following conclusions:

Different lubricants do not necessarily give the same friction coefficient, and their lubricating value can be determined by means of this apparatus.

Constancy of friction requires a liberal supply of lubricant, particularly when there is a difference of steam pressure on the two sides of the piston.

Cutting off or reducing the supply of lubricant brings about an increase of friction within 5 min.

Increasing the supply of lubricant may bring about a reduction of friction within 15 min., but at low pressures, or when starting a run with surfaces free from oil, it may take two hours to reach a consistently low value of friction.

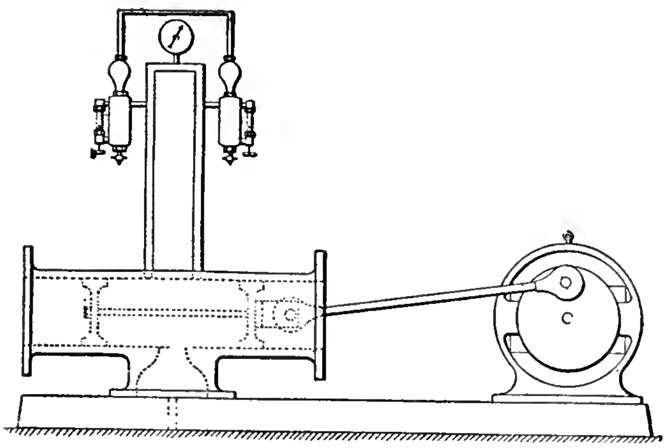


FIG. 1. DIAGRAM ILLUSTRATING PRINCIPLE OF CYLINDER FRICTION APPARATUS.

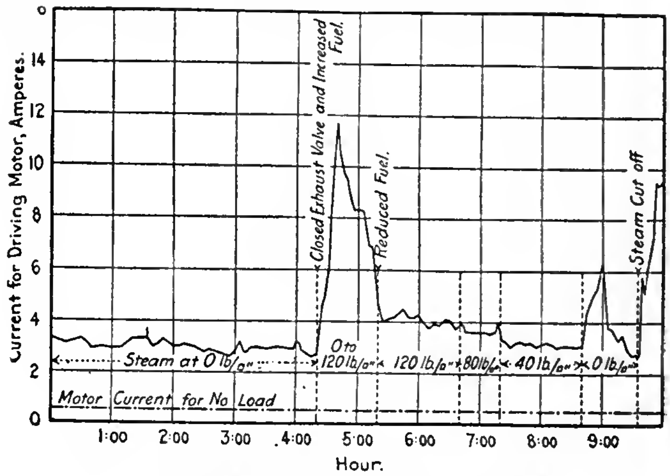


FIG. 2. READINGS AS TAKEN IN A TEST.

the two pistons by means of a crank disc and connecting-rod, and the net input of the motor is a direct measure of the friction of the two pistons and piston rings.

Full Size Apparatus

Actual dimensions of the apparatus are: Cylinder, 8-in. bore x 36-in. long, with a 3-in. drain from the middle of the bottom; connecting-rod 33 in. long, which with a stroke of 8 in. makes the maximum angularity of the connecting-rod less than 7 deg.

Ball bearings at each end of the rod make the connecting-rod friction negligible compared with the cylinder friction.

Two 1-pint. Detroit sight-feed lubricators supply oil in the usual manner to the steam pipes.

The piston-rings at present in use are of the constant-radial-thickness type. Each piston has five slots and one or all

*From a paper read at the recent annual meeting of American Society for Testing Materials.

**Professor of Electrical Engineering, Ohio StSate University, Columbus, Ohio.

heat. A set of readings is plotted in Fig. 2.

Peculiar Results

Variations observable in this test were largely due to the difficulty of controlling the oil feed. There was an excessive rise in friction amounting to 300-400 per cent. when the steam pressure was raised quickly from atmospheric pressure to 120 lb. per sq. in. This excessive friction does not occur when the steam pressure is increased gradually or when it is lowered; presumably it is caused by the sudden blowing of the oil out from the space between the piston-rings and the cylinder walls.

The effect of shutting off one of the two lubricators was to increase the friction within a few minutes, in spite of the fact that some oil was carried to the end at which the lubricator was shut off.

Shutting off all the lubricant caused an appreciable increase of friction within five minutes, when steam is present under pressure, but when steam is present

An increase in the rate of feed of the lubricant makes a considerable reduction in the friction when the amount fed is small, but with a continued increase of feed of lubricant, the friction tends to approach a certain minimum value.

The friction coefficients obtained so far are all large, 3 to 4 per cent. or more, and very much larger than the values found in well-lubricated bearings.

The friction coefficients obtained and the amount of lubricant necessary are greatly modified by the presence of steam pressure on the two sides of the piston.

The progressive employer is a firm believer in the fair-mindedness of average workmen, and believes it pays to take them fully into his confidence, and not only tell them what, but why. If we would all take the trouble to confide in and confer with our men freely and frankly, many of us would be surprised to find some hard-headed workman who can think just as fast as we can and who may have some good ideas in his stubborn head which it is up to us to get out.

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ORDNANCE MAKING AS A CANADIAN INDUSTRY

THE demands which the future may have in store are the subject of much speculation and not a little misgiving by many of the numerous manufacturers who so promptly and efficiently transformed their peacetime factories into branch arsenals. When the call for shells was made, the manner in which Canadian manufacturers responded aroused considerable interest in the United States, and now when various firms in that country are getting down to a capacity basis on shell production they are frank in admitting their indebtedness to, and expressing their admiration for the many firms in Canada who so willingly placed all available information and experience at their disposal.

With a very few exceptions, our home manufacturers were engaged on contracts for the British War Office, while many of our neighbors were producing Russian ammunition. The strictness of British War Office requirements and the closeness of inspection, while somewhat irksome at times, were perhaps blessings in disguise, and demonstrated that our manufacturers are entitled to share first place with any other ammunition producers, whether British or foreign, Government or private.

The feeling of pride and satisfaction at being able to render patriotic service of such value has spread through all grades of producers; old men and boys have helped the cause in quite as effective a manner as if they had been eligible for enlistment, while many families who might otherwise have no direct interest in the war have been maintained in comfort as a result of their heads being engaged in shell making.

The impending decrease and the ultimate fading away of such a source of support will certainly go hard with many firms and individuals. Reports which continue to arrive regarding the unabated activity of the British Minister of Munitions are not calculated to have a very encouraging effect on producers here.

Despite desires to the contrary, the question which our shell makers are asking themselves is only intensified by the increasing activity of the Provincial Munitions Committees in Britain. Why, we feel constrained to ask should our manufacturers be left in the air, while Lloyd George continuously demands a doubling and trebling of the army of munition producers in Britain, an increase many times greater than the whole number of persons so employed in Canada?

The recent discussion regarding the proposed production of guns in this country may hold out hopes of continued activity to certain firms, but the efficiency of such a development as an aid in the war is very doubtful. In its economic aspect as a source of livelihood to a large proportion of the population it would be practically nil compared with shell production.

A gun and its projectile represent very clearly the two extremes of production methods.

Guns are costly. They are heavy. They require machine tools and other equipment for their production which by reason of their cost, and time required for installation, confine the possibilities of successful manufacture to a very limited number of firms. The cost of guns is not so much the amount of human labor due to numerous employees as the interest on vast plant expenditure. Wherefore then would the value of a large contract be of benefit to the country as a whole.

Shells are cheap. Their manufacture is second nature to Canadians. Their cost might be reduced by careful consideration, and the proportion of cost represented by wages is far and away greater than in guns. The actual total time that a shell is being worked on in machines may be measured almost in minutes, instead of days or weeks, as with a gun, while the individuals who share in the former time are at least ten as compared with one on gun making.

Ordnance making as a war-time industry will never benefit Canada to the extent supposed, and while it is hoped that with the successful accomplishment of "fixing," a call for further shell production may be issued, the time which must necessarily elapse in order to allow of the "fixing" catching upon production, is so great that many of our shell makers may well be pardoned for looking askance at the latest suggestion.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey forge, Pittsburgh	$14 70	
Lake Superior, charcoal, Chicago	15 75	
Ferro Nickel pig iron (Soo)	25 00	
	Montreal.	**Toronto.**
Middlesboro, No. 3	22 00	.....
Carron, special	23 00	.....
Carron, soft	23 00	.....
Cleveland, No. 3	22 00	.....
Clarence, No. 3	22 50	.....
Glengarnock	26 00	.....
Summerlee, No. 1	28 00	.....
Summerlee, No. 3	27 00	.....
Michigan charcoal iron.	26 00	.....
Victoria, No. 1	23 00	19 00
Victoria, No. 2X	22 00	19 00
Victoria, No. 2 plain..	22 00	19 00
Hamilton, No. 1	22 00	19 00
Hamilton, No. 2	22 00	19 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	2.20
Steel bars, f.o.b., Toronto	2.20
Common bar iron, f.o.b., Montreal	2.20
Steel bars, f.o.b., Montreal	2.20
Twisted reinforcing bars	2.20
Bessemer rails, heavy, at mill....	1.25
Steel bars, Pittsburgh	1.30
Tank plates, Pittsburgh	1.30
Beams and angles, Pittsburgh....	1.30
Steel hoops, Pittsburgh	1.40
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.10
Small shapes	2.35
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.90
Structural shapes	1.95
Plates	1.95

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ¼ to ½ in., 100 lb.	$2 35	$2 25
Heads, per 100 lb.	2 55	2 45
Tank plates, 3-16 in.	2 60	2 45

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$12 25	$12 00
Copper, crucible	13 25	13 00
Copper, unch-bled, heavy	13 25	13 00
Copper, wire, unch-bled.	14 00	14 00
No. 1 machine compos'n	11 50	11 50
No. 1 compos'n turnings.	9 00	9 00
No. 1 wrought iron	6 50	6 50
Heavy melting steel	7 00	7 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings....	11 00	11 00
No. 1 brass turnings....	9 00	9 00
Heavy lead	5 00	5 00

Tea lead	$ 3 25	$ 3 50
Scrap zinc	8 50	9 00

W. I. PIPE DISCOUNTS.

Following are Toronto jobbers' discounts on pipe in effect Aug. 27, 1915:

	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
Standard				
¼, ⅜ in.	63	38½	....	....
½ in.	68	47½	....	....
¾ to 1½ in. ..	73	52½	....	....
2 in	73	52½	69	48½
2½ to 4 in ...	73	52½	72	51½
4½, 5, 6 in...	....	....	70	49½
7, 8, 10 in. ...	....	....	67	44½
X Strong P. E.				
¼, ⅜ in.	56	38½	....	....
½ in.	63	45½	....	....
¾ to 1½ in. ..	67	49½	....	....
2, 2½, 3 in. ..	68	50½	....	....
2 in.	....	....	63	45½
2½ to 4 in. ..	....	....	63	48½
4½, 5, 6 in. ..	....	....	66	48½
7, 8 in.	....	....	59	39½
XX Strong P. E.				
½ to 2 in.	44	26½	....	....
2½ to 6 in. ...	....	....	43	25½
7 to 8 in.	....	....	40	20½
Genuine Wrot Iron.				
⅜ in.	57	32½	....	....
½ in.	62	41½	....	....
¾ to 1½ in. ..	67	46½	....	....
2 in.	67	46½	63	42½
2½, 3 in.	67	46½	66	45½
3½, 4 in.	....	....	66	45½
4½, 5, 6 in. ..	....	....	63	42½
7, 8 in.	....	....	60	37½

Wrought Nipples.	
4 in. and under	77½%
4½ in. and larger	72½%
4 in. and under, running thread.	57½%
Standard Couplings.	
4 in. and under	60%
4½ in. and larger	40%

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws....	65%
Sq. Head Set Screws	65 & 10%
Rd. & Fil. Head Cap Screws......	45%
Flat & But. Head Cap Screws....	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in. N.	70%
Semi-Fin. Nuts up to 1 in.	70%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

METALS.

	Montreal.	Toronto.
Lake copper, carload ...	$20 00	$19 00
Electrolytic copper	20 00	18 75
Castings, copper	19 75	18 50
Tin	39 00	39 00
Spelter	18 00	18 00
Lead	6 15	6 25
Antimony	38 00	35 00
Aluminum	50 00	40 00

Prices per 100 lbs.

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh...	$24 00
Openhearth billets, Pittsburgh..	24 50
Forging billets, Pittsburgh	32 00
Wire rods, Pittsburgh	30 00

NAILS AND SPIKES.

Standard steel wire nails, base	$2 40	$2 35
Cut nails	2 50	2 70
Miscellaneous wire nails..	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	75
Stove bolts	80
Plate washers	40
Machine bolts, ⅜ and less......	70
Machine bolts, 7-16 and over....	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass.....35 p.c.	
Nuts, square, all sizes..4¼c per lb. off	
Nuts, Hexagon, all sizes.4¾c per lb. off	
Iron rivets .... 72½ per cent.	
Boiler rivets, base, ¾-in. and larger	$3.25
Structural rivets, as above.......	3.25
Wood screws, flathead, bright ....85, 10, 7½, 10 p.c. off	
Wood screws, flathead, Brass ....75 p.c. off	
Wood screws, flathead, Bronze ....70 p.c. off	

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Standard. Price. per ft.	Extra Strong, Sizes Ins.	Extra Strong, Price per ft.	D. Ex. Strong, Size Ins.	D. Ex. Strong, Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.....
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....

COKE AND COAL.

Solvay Foundry Coke	$5.75
Connellsville Foundry Coke	5.00
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

COLD DRAWN STEEL SHAFTING.

At mill	45%
At warehouse	40%

Discounts off new list. Warehouse price at Montreal and Toronto.

MISCELLANEOUS.

Solder, half-and-half	0.24
Putty, 100-lb. drums	2.70
Red dry lead, 100-lb. kegs, per cwt.	9.65
Glue, French medal, per lb.	0.18
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.18
Benzine, single bbls., per gal.	0.18
Pure turpentine, single bbls.	0.64
Linseed oil, raw, single bbls.	0.65
Linseed oil, boiled, single bbls.	0.68
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Lead wool, per lb.	0.10
Pure Manila rope	0.16
Transmission rope, Manila	0.20
Drilling cables, Manila	0.17
Lard oil, per gal.	0.73
Union thread cutting oil	0.60
Imperial quenching oil	0.35

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto 40%

PROOF COIL CHAIN.

1/4 inch	$8.00
5-16 inch	5.35
3/8 inch	4.60
7-16 inch	4.30
1/2 inch	4.05
9-16 inch	4.05
5/8 inch	3.90
3/4 inch	3.85
7/8 inch	3.65
1 inch	3.45

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	60
Carbon over 1½ in.	25
High Speed	40
Blacksmith	60
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Centre	25
Pipe Reamers	80

Discounts off standard list.

IRON PIPE FITTINGS.

Canadian malleable, A, 25 per cent.; B and C, 35 per cent.; cast iron, 60; standard bushings, 60 per cent.; headers, 60; flanged unions, 60; malleable bushings, 60; nipples, 75; malleable, lipped unions, 65.

TAPES.

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3.50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$2 70	$2 70
Canada plates, dull, 52 sheets	3 15	3 15
Canada Plates, all bright	4 75	4 75
Apollo brand, 10¾ oz. galvanized	6 40	5 95
Queen's Head, 28 B.W.G.	6 00	6 25
Fleur-de-Lis, 28 B. W. G.	5 75	5 75
Borbal's Best, No. 28	6 00	6 00
Viking metal, No. 28	6 00	6 00
Colborne Crown, No. 28	5 38	5 30
Premier No. 28	5 60	5 50

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$11 00	.....
1¼ in.	11 00	.....
1½ in.	11 00	.....
1¾ in.	11 00	.....
2 in.	11 50	8 75
2¼ in.	13 00	10 50
2½ in.	14 00	11 15
3 in.	16 00	12 10
3½ in.	20 00	14 15
4 in.	25 50	18 00

Prices per 100 feet, Montreal and Toronto.

WASTE.

WHITE.	Cents per lb.
XXX Extra	0 11
X Grand	0 10½
XLCR	0 09¾
X Empire	0 09
X Press	0 08¼
COLORED.	
Lion	0 07½
Standard	0 06¾
Popular	0 06
Keen	0 05½
WOOL PACKING.	
Arrow	0 16
Axle	0 11
Anvil	0 08
Anchor	0 07
WASHED WIPERS.	
Select White	0 08½
Mixed Colored	0 06¼
Dark Colored	0 05¼

This list subject to trade discount for quantity.

BELTING RUBBER.

Standard	50%
Best grades	30%

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50%
Standard	50 & 10%
Cut leather lacing, No. 1	$1.20
Leather in sides	1.10

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	$9.00
1/4 in.	6.25
5-16 in.	4.65
3/8 in.	4.00
7-16 in.	4.00
1/2 in.	4.00

Prices per 100 lbs.

PLATING CHEMICALS.

Acid, boracic	$ .15
Acid, hydrochloric	.05
Acid, hydrofluoric	.06
Acid, Nitric	.10
Acid, sulphuric	.05
Ammonia, aqua	.08
Ammonium carbonate	.15
Ammonium chloride	.11
Ammonium hydrosulphuret	.35
Ammonium sulphate	.07
Arsenic, white	.10
Copper sulphate	.10
Cobalt Sulphate	.50
Iron perchloride	.20
Lead acetate	.16
Nickel ammonium sulphate	.10
Nickel carbonate	.50
Nickel sulphate	.17
Potassium carbonate	.40
Potassium sulphide	.30
Silver chloride (per oz.)	.65
Silver nitrate (per oz.)	.45
Sodium bisulphite	.10
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.35
Sodium hydrate	.04
Sodium hyposulphite (per 100 lbs.)	3.00
Sodium phosphate	.14
Tin chloride	.45
Zinc chloride	.20
Zinc sulphate	.08

Prices Per Lb. Unless Otherwise Stated.

ANODES.

Nickel	.47 to .52
Cobalt	1.75 to 2.00
Copper	.22 to .25
Tin	.45 to .50
Silver	.55 to .60
Zinc	.22 to .25

Prices Per Lb.

PLATING SUPPLIES.

Polishing wheels, felt	1.50 to 1.75
Polishing wheels, bullneck	.80
Emery in kegs	.4½ to .06
Pumice, ground	.05
Emery glue	.15 to .20
Tripoli composition	.04 to .06
Crocus composition	.04 to .06
Emery composition	.05 to .07
Rouge, silver	.25 to .50
Rouge, nickel and brass	.15 to .25

Prices Per Lb.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., Sept. 20, 1915.—The continued demand from all quarters for war supplies and the optimistic feeling that in a short time this situation may further develop, keeps the industrial community as far as the war is concerned, moving at almost maximum activity.

Steel

The outstanding feature, as usual, is the demand for steel, this keeping the mills operating practically at capacity. While it was feared some months ago that the iron and steel industry might be affected to some extent by a possible shortage of labor, or that the demand would grow to such an extent that a shortage would occur in coke, pig iron, etc., at the present time the feeling generally expressed is that no serious restrictions will be placed on production for war supplies, particularly as the domestic situation in this direction shows little signs of returning to normal.

However, if the demand for steel for the manufacture of shells larger than those now being produced becomes general, which seems altogether probable, it will likely tax our mills to their very utmost, especially in the matter of billets, as the larger shells will be made from this class of product. There are indications that orders for large shells have already been received or are expected in the near future. Several plants are being equipped for the production of 6-inch shells and larger, one firm in Montreal hoping to start making the former in about a month.

Pig Iron

This market, while showing increased activity in some localities, generally remains stationary; quotations are practically the same as for the previous week.

Machine Tools and Supplies

The machinery market is little changed from that of last week. In some cases dealers are beginning to express the opinion that some difficulty may arise in securing suitable machines necessary for the production of large shells which from present indications are likely to be required. The machine tools that a large number of manufacturers have installed for the making of the smaller shells will be wholly inadequate for the production of the larger type, but those plants that have lately taken up the work of shell making and have installed somewhat heavier tools, not being able to get others in time, will be in a good position to accept orderes for the larger shells. This new feature in shell production will also create a demand for machine supplies in the way of special attachments. These in turn may develop some new features in tool design.

Metals

Metal quotations show little change, the situation keeping generally firm. Copper is slightly stronger in some directions, but other metals show a decline. The feature has been the jump in aluminum which is quoted at 50c per pound.

Very little change is to be noted in the price of old materials. However, owing to the rise in aluminum, the quotations in its scrap have correspondingly increased.

EQUIPMENT FOR AUSTRALIAN NAVAL DOCKYARD

D. H. Ross, Trade Commissioner at Melbourne, has cabled the Department of Trade and Commerce, Ottawa, to the effect that the tenders for the naval dockyards in Australia, which were detailed in our August 26 issue, have been extended to November 30. It was stated then that the tenders would close during the last week in October. As was mentioned also in the former article, the above mentioned tender forms have been received and may be inspected by interested Canadian manufacturers at the Department of Trade and Commerce, Ottawa. (Refer to File No. 1747.)

CANADIAN GOVERNMENT PURCHASING COMMISSION

The following gentlemen constitute the Commission appointed to make all purchases under the Dominion $100,000,000 war appropriation:—George F. Galt, Winnipeg; Hormidas Laporte, Montreal; A. E. Kemp, Toronto. Thomas Hilliard is secretary, and the commission headquarters are at Ottawa.

Toronto, Ont., Sept. 21.—There is little change to note in general business conditions. The gradual improvement in trade is being maintained and the volume of business is greater than it was for the corresponding period of last year. A better feeling prevails in business circles due to improved conditions and a better outlook for the future.

A new development in the engineering field is the proposal to manufacture artillery in Canada. Although this class of work requires considerable skill and is highly technical, the committee appointed by the Dominion Government has reported favorably on the possibility of making guns. The order is said to amount to sixty-five million dollars and the four grades of guns to be covered are the twelve-pounder, eighteen-pounder, 4.5-gun and the howitzer. Further developments have to be recorded in the munitions business. The Canadian Car & Foundry Co. have received another order for Russian shells worth, it is stated, over 50 million dollars. It is reported as being probable that a part of this order will be sub-let to Canadian concerns, the National Steel Car and Montreal Ammunition Co. being mentioned as probable participants.

Steel Market

The general situation in the steel trade is much the same as during the past few weeks, the brisk demand for forgings and rounds for shells continues, in addition to the big export business. There is such a big demand for steel for shells that Canadian mills cannot take care of all the business and inquiries have been sent to the States for 35,000 tons of steel rounds. The building trade is still very dull and there is little demand for structural shapes. Prices on bars, plates and shapes are unchanged but are holding very firm.

The improvement in the steel trade in the States continues and the situation is strong, particularly in open-hearth steel, for which there is a continued heavy demand. Prices on open-hearth products are very strong, and prices are almost certain to be higher. There is a continued heavy demand for rounds for shells and prices are holding very firm. A scarcity of wire rods is reported and quotations have advanced to $30, Pittsburgh. There is an active demand for billets and prices are firm the the advance announced last week.

Pig Iron

There is no change in the pig iron situation and conditions in the market continue much the same. Quotations on all brands are unchanged.

Scrap Metals

Prices of scrap metals, particularly copper, are firm, and heavy melting steel is strong. Fair business is reported and quotations are unchanged.

Machine Tools

Activity in the machine tool business

is not so much marked as a few weeks ago, and there is a lessening demand for new tools. Deliveries are still very backward, which is causing a more active demand for second-hand tools. The probability of further shell orders being distributed is interesting the trade, and a revival in business is anticipated shortly.

Supplies

Business continues brisk in machine shop supplies and prices are holding firm all round. The linseed oil market has re-acted and quotations are 2c higher, raw oil being quoted at 65c and boiled at 68c per gallon. Turpentine has also advanced 2c and is now quoted at 64c per Imperial gallon. Prices of leather belting are very firm and an active demand continues.

Metals

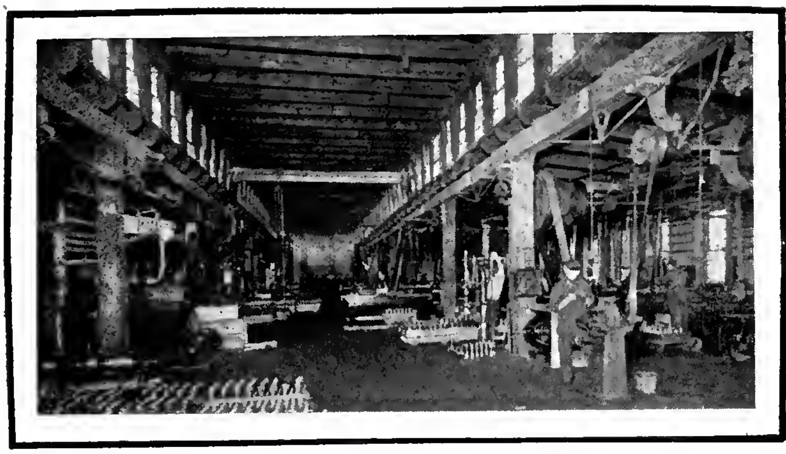
With the exception of a decline in antimony there are no price changes to note this week. The markets are steady at the lower levels recorded last week. As foreign exchange is intimately associated with the metal markets, the negotiations which are being conducted in New York between representatives of the British and French Governments and American bankers are naturally being followed closely by the trade. Both buyers and sellers are waiting developments and a rise in exchange will materially improve the prospects of doing business. There is some uncertainty in the tin market in New York as to how the new regulations imposed by the British Government will work out. The copper market is higher in London, but unchanged here, although the tone has improved. There has been more interest taken in the spelter market, but few sales have been made. The lead market is stagnant and prices unchanged. Antimony is easier because of a desire to reduce surplus stock, while aluminum is higher and quotations nominal.

Tin.—The market is dull, both in London and New York. There is very little inquiry for tin, both buyers and sellers are apparently awaiting developments regarding the loan which the representatives of the Allied Governments are negotiating in New York. Local quotations on tin are unchanged at 39c per pound.

Copper.—The British war loan negotiations are affecting the copper market but the outlook is brighter in anticipation of the loan being satisfactorily arranged. The market is firmer and quotations are unchanged at 19c per pound.

Spelter.—The market is quiet and unchanged. There is no disposition to cut the "Trust" price of 4.50 New York at present. Local quotations are unchanged at 6¼c per pound.

Antimony.—The market is quiet and



Shrapnel Shell Manufacture

In a Plant Producing Sheet Metal Working Machinery

Staff Article

The diversity of products formerly manufactured by what are now shell making establishments is perhaps only equalled by the originality and resource displayed in the methods invoked in the prosecution of the new industry. Dissimilarity between past and present activity has certainly had no deterrent effect on the continuity of successful operation which the plant described has always enjoyed, a fact which reflects credit on all concerned.

SHRAPNEL shell production has now attained such proportions that the detail description of its manufacture has become familiar to a large number of readers of mechanical and other papers; but, although the general cycle of operations in most establishments are similar to each other, the method of obtaining these results in the various plants differ to such an extent that a visit to the different factories impresses upon the observer the energies and resources employed and adopted by enterprising men to meet and overcome these problems with which they have been confronted.

The object of this article is not to describe the manufacture of shrapnel shells, but to show the means whereby some interesting and original methods were practised to eliminate and overcome obstacles that often become evident in cases of this kind where a new article must be produced from equipment intended for an entirely different product.

To describe these various methods, a brief outline of the different operations in this plant may be advisable.

After the rough forging has been marked for length, it is taken to the machine shown in Fig. 1. This tool (an old Hurlbut Rogers cutting-off machine) was practically in the scrap heap at the time, but was taken and remodeled as shown. The original friction drive from the front and rear was replaced by a powerful clutch drive from the end of the machine.

Roughing the Body.

Roughing the body was done on a Stevens & Co. $2\frac{1}{4}$ in. flat turret lathe, shown in Fig. 2. The shell is held on an expanding arbor and driven by the dog shown. A light cut is taken for a short distance, until the shell is supported from the rear with the two rolls shown in the cutter head. The feed is then thrown in and the rough cut taken. To put the round corner on the end of shell the cutter head, shown in Fig. 3, is used. The cutter (C) is securely held between two pieces (b) (b) in the head (d) and adjusted by the screw (a).

Roughing the Nose.

The fourth operation is the roughing of the nose and finishing the recess at the base of the shell for the powder cup.

This is also done on a Stevens $2\frac{1}{4}$ in. flat turret lathe. The shell is held in a special chuck designed in the shop, which proves very satisfactory. The details are shown in Fig. 4.

The casting A is bolted to a face plate on the spindle. The three section collet B is drawn in by means of the piece C, which is connected with a hand wheel at the rear of the lathe spindle by the rod D. The collet is kept expanded when released by means of the coil springs E.

Undercutting and Grooving.

The cutting of the groove, undercutting and waving are done on a Bertram lathe, with Bertram's waving and undercutting attachments. The waves are then nicked with a flat chisel to allow the air to escape when the copper band is pressed on; this also aids in preventing the band from turning when shell is leaving the gun.

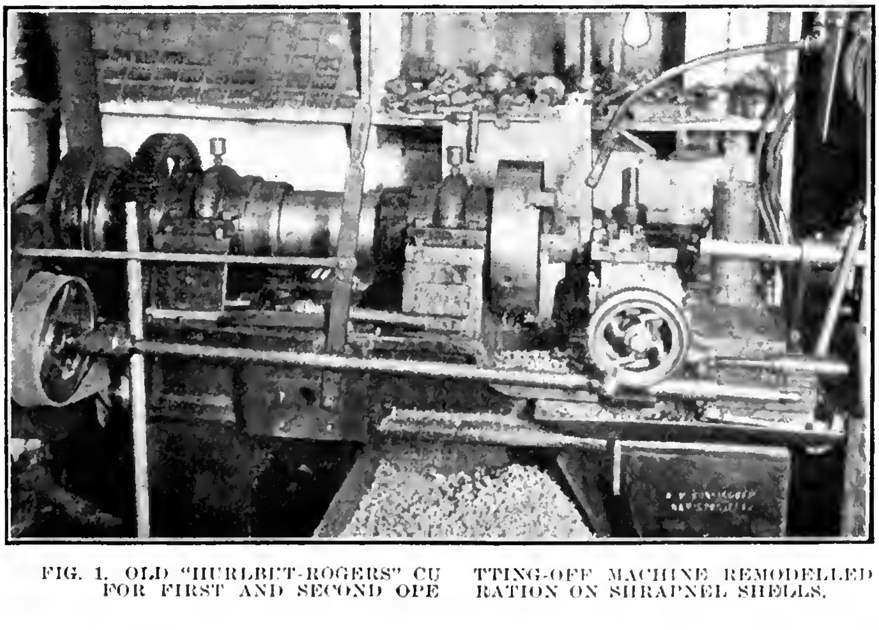


FIG. 1. OLD "HURLBUT-ROGERS" CUTTING-OFF MACHINE REMODELLED FOR FIRST AND SECOND OPERATION ON SHRAPNEL SHELLS.

Hardening and Nosing.

The shells are now heated in a natural gas furnace to a temperature of about 1,450° F. and hardened in a bath of special oil.

After buffing and testing with the scleroscope for the proper degree of hardness, which is about 45° on the graduated scale, they are re-heated in a special nose-heating furnace in a bath of

molten lead a short distance from the end and placed in a nosing press. Before the operation of nosing takes place the steel diaphragm is dropped in and the nose is then formed and placed in a box of lime to anneal for further machining.

Machining the Nose.

After annealing, the shells are taken to a Jones & Lamson flat turret and

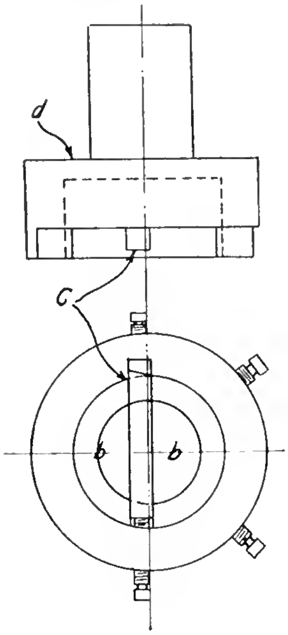


FIG. 3. RADIUS FORMING TOOL.

held in a chuck of the type shown in Fig. 4, and the nose rough-turned to the desired shape, faced, bored and undercut, and threaded for the fuse socket.

Grinding.

A centre plug is then screwed in the nose, and they are placed in a Ford Smith grinding machine and ground with a shaped wheel to the desired size of body and contour of nose.

While being ground the butt end of the shell is held in the chuck shown in Fig. 5. The piece of machine steel A is threaded internally to fit the lathe spindle and threaded outside to receive the nut B. This nut clamps the collet ring C (which is of 4 sections) upon the butt end of the shell. The spring D shown in the cross section of the ring at E for keeping section expanded when chuck is released.

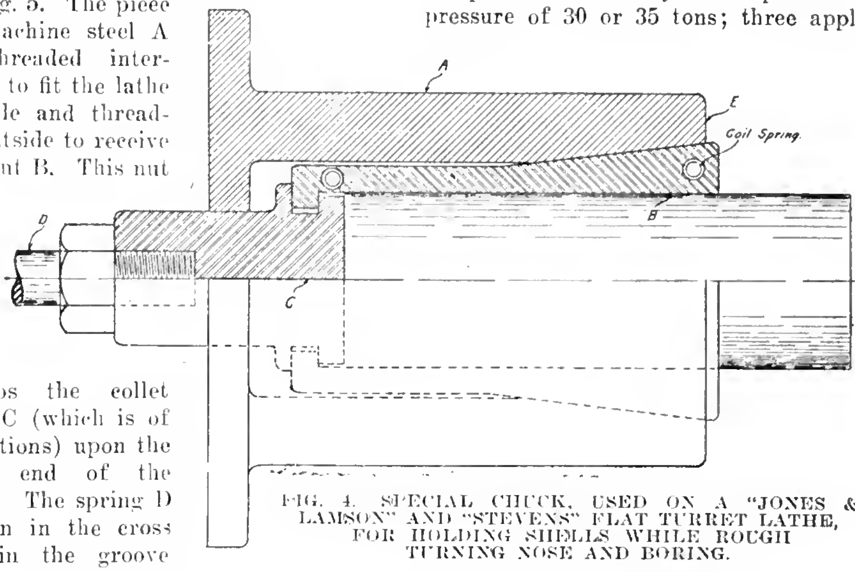


FIG. 4. SPECIAL CHUCK, USED ON A "JONES & LAMSON" AND "STEVENS" FLAT TURRET LATHE, FOR HOLDING SHELLS WHILE ROUGH TURNING NOSE AND BORING.

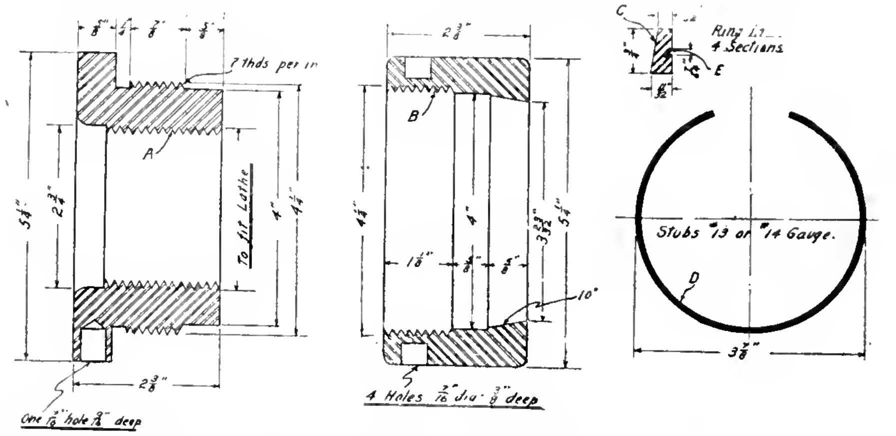


FIG. 5. CHUCK FOR HOLDING BUTT END OF SHELL WHILE BODY OF LATTER IS BEING GROUND.

Putting on Copper Band.

After being ground the copper bands are pressed on in a hydraulic press at a pressure of 30 or 35 tons; three applications are given, the shell being turned a little each time.

Filling the Shells.

After the band turning operation the shells are ready to receive the charge

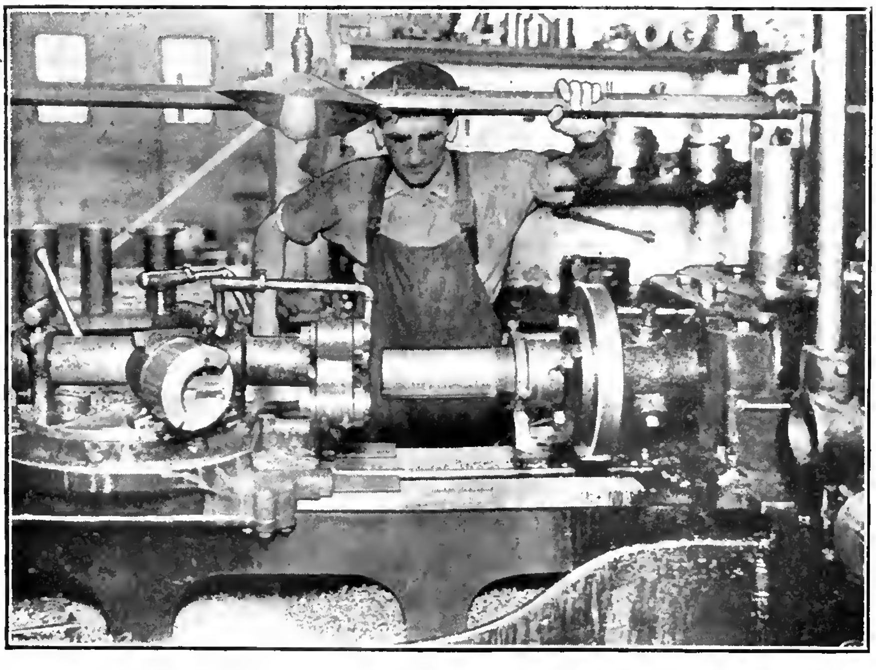


FIG. 2. ROUGH TURNING SHELL BODY ON "STEVENS" FLAT TURRET LATHE.

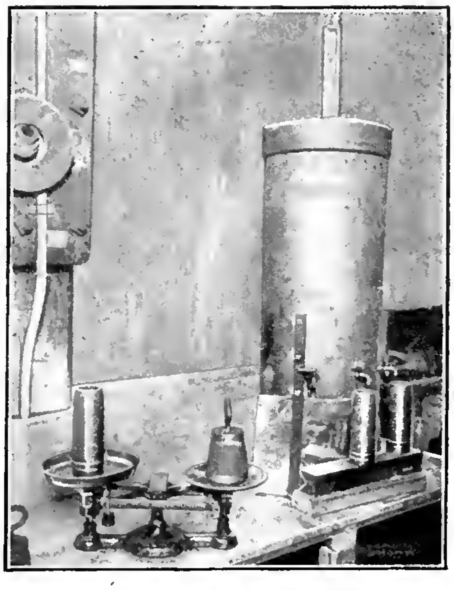


FIG. 6. RESIN MELTING FURNACE SHOWING SHELL FILLING AND WEIGHING ARRANGEMENTS.

of bullets and resin. The tin powder cup is first put in and allowed to fall into position beneath the diaphragm. The shell is placed on end and the brass tube screwed into the diaphragm. After filling the space around the tube with bullets the shell is placed on an air vibrator and the shot jarred and packed in until the weight of shell and bullets equal 16 lbs. 6 oz. 7 dr. The shell is then placed beneath the tap in the resin melting furnace shown in Fig. 6 and sufficient molten resin allowed to run in to bring the weight up to 17 lbs. 2 oz. 10 dr., one of the balls in the

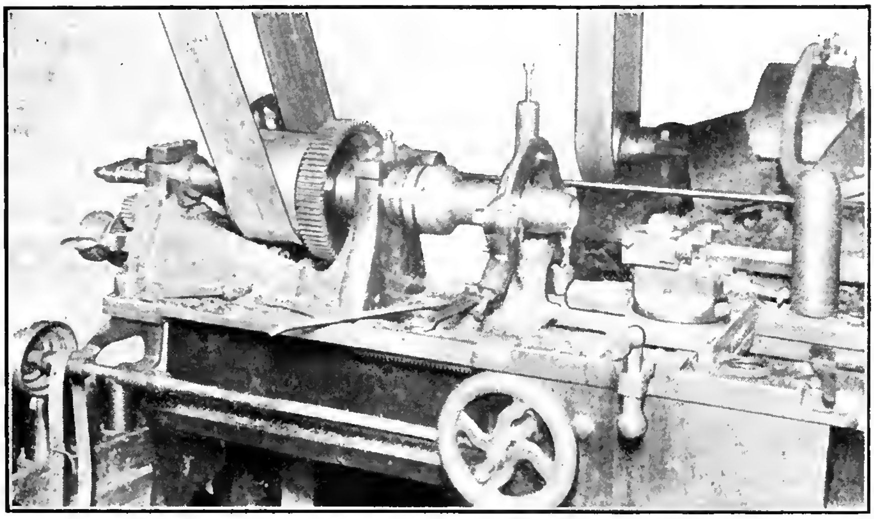


FIG. 7. FINISHING NOSE OF FUSE SOCKET ON LATHE WITH SPECIAL DRIVE.

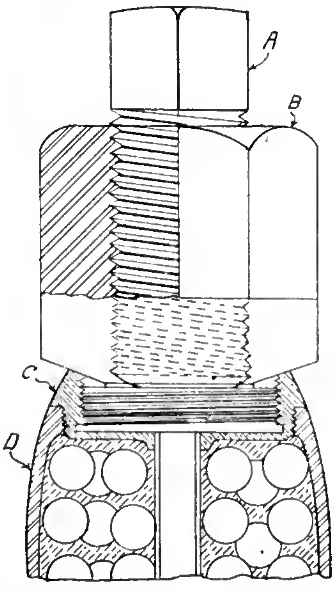


FIG. 8. TOOL FOR REMOVING BRASS SOCKETS.

shell being placed over the opening in the tube to prevent the resin from flowing in.

Finishing the Fuse Socket.

The shells are then held in a chuck and the fuse socket firmly screwed in. They are then held in a chuck similar to that shown in Fig. 5 on a London tool lathe and the rough part of the fuse socket finished to the desired shape and size. A feature of this operation was the replacing of the ordinary cone pulleys by a single wide faced pulley to increase the driving power. This operation is shown in Fig. 7.

Final Weight Test.

The shell is now ready for the final test for weight and inspection before painting. The weight at this point

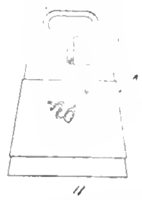


FIG. 11. LIMIT WEIGHT.

should be 17 lbs. 10 oz. 14½ dr. This was done on a Gurney scale. Now, if the shell weighs more than the limit allowed the base is faced off until the desired weight is obtained, but, if on the other hand the shell is too light the fuse socket must be removed and sufficient small shot added to bring it up to the required weight. To remove this fuse socket after it is finished requires some careful handling. The tool shown in Fig. 8 was used for this purpose. A is a threaded plug which screws into the fuse socket C. The shank of piece A is threaded left hand and squared on the end, the nut B is threaded to fit the thread on the shank. The shell is securely held in a chuck and the plug

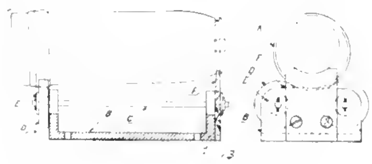


FIG. 13. PAINTING JIG.

screwed in, then the nut is screwed on until it comes in contact with nose of fuse socket, further pressure causes the socket to unscrew when the additional weight is inserted and socket replaced.

Facing Fuse Socket.

The beveled bearing on the nose of the socket is then finished by facing

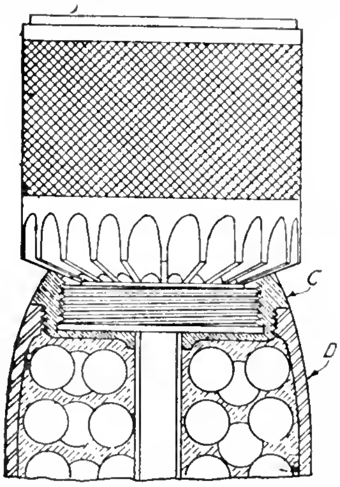


FIG. 9. TOOL FOR BEVELLING BRASS SOCKETS.

with the tool shown in Fig. 9. The threaded plug with shank extended as

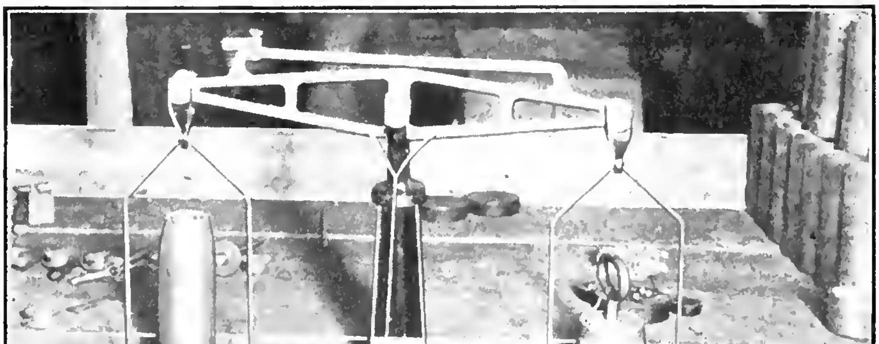


FIG. 10. INSPECTION BENCH SHOWING A FEATURE IN THE USE OF A SINGLE WEIGHT TO TAKE THE PLACE OF SEVERAL STANDARD WEIGHTS.

at A, Fig. 8, is screwed into the socket and the knurled rosebit B placed over the shank and turned by hand making a smooth joint for the time fuse piece.

Weighing Feature.

A feature in connection with the weighing of the shells at various stages was the replacing of several standard weights by one solid weight, as that shown on the scales in Fig. 10. This weight is more clearly shown in Fig. 11. The piece A was cast of a weight about equal to the required weight then drilled and tapped to receive the eye bolt B. The ends of piece A were then turned off until the exact weight was reached and then used in preference to the other weights and the adjustable weight on the upper beam. Instead of using this movable weight on the beam for finding the amount under or over, the piece of string solder, shown at C, was made the exact weight allowed over and above. This piece is shown on the top of weight in Fig. 10.

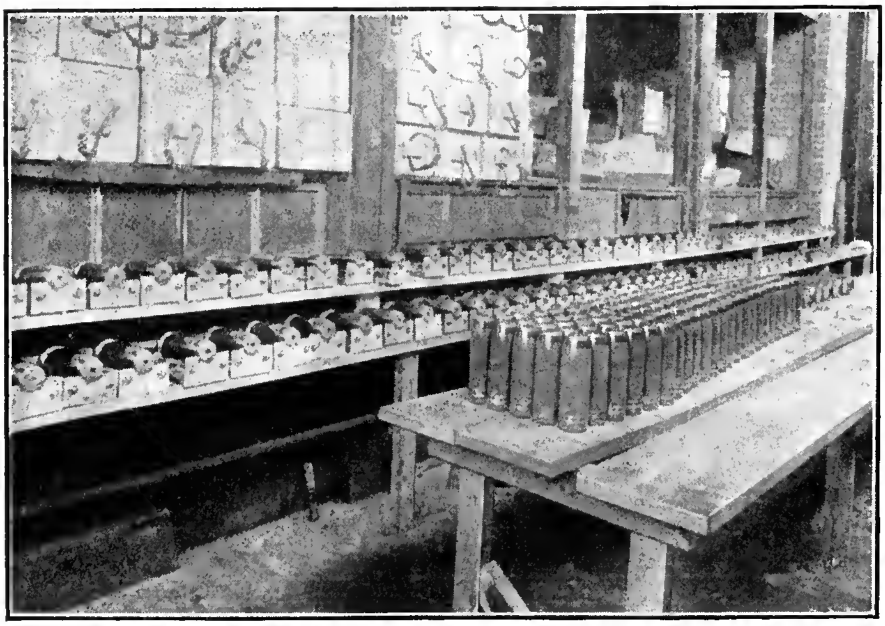


FIG. 12. SHELL PAINTING DEPARTMENT.

Marking and Painting.

After the shells have been finally passed they are marked in a Brown Boggs marking machine. They then go to the painting department a view of which is shown in Fig. 12. The cases in the upper left hand corner are used in shipping the finished shell. The jig used for painting the shell, of which there are a large number, is shown in Fig. 13. The frame is a light casting which carries the two shafts C on which are the rollers D held in position as shown. At the front end is a thin piece of board secured to the frame and hollowed out to receive the nose of the shell; a crank handle is fitted in the square hole and the shell revolved while being painted.

This plant is turning out from two to three series, (240 to 360) shells a day.

CANADIAN LIGNITE INVESTIGATION.

LIGNITE obtained from the Province of Alberta has been under investigation by the Department of Mines, Ottawa, and a report of over 100 pages has been issued covering the results. This report, which is made by B. F. Haanel, chief of the Fuels and Fuel Testing Division of the Department, and John Blizard, states that in an extended number of trials in gas producers the fuel was found eminently suited for such gas production. In fact, it is suggested that the nitrogen content is sufficiently high to make recovery of ammonia or ammonium sulphate profitable. It is added that no trouble was experienced in utilizing the gas in a gas engine.

The tests cover also the use of the lignite under steam boilers, and it was concluded that lignites with a moisture content up to 30 per cent. do not materially affect boiler efficiency. It is explained that fuels of this class require a specially large combustion chamber and a brick ignition arch arranged to burn the large percentage of volatile matter contained.

HARDNESS AND WEARING TESTS OF METALS

AT the suggestion of the Hardness Tests Research Committee of the Institution of Mechanical Engineers, some comparisons of the results of the different methods of testing the hardness and wearing properties of metals have been made. using specimens supplied by Sir Robert Hadfield. The comparisons made up to the present time have been between the results of the "Brinell" ball hardness test and the "Saniter" wear test.

For the purpose of making the latter test, the existing Wöhler fatigue testing machine was used with a 1-in. specimen rotating at 2,200 r.p.m. A hardened steel ring of 1½-in. internal diameter and 0.25 in. wide, was placed on the specimen and loaded with a weight of 210 lb. The wear was taken as the reduction in diameter of the specimen in ten-thousandths of an inch after 200,000 revolutions of the specimen. The results showed that the relation between the "Brinell" hardness number and the resistance to wear (as given by the reciprocal of the wear in ten-thousandths of an inch multiplied by 1.000), depends largely on the composition of the steel. In ordinary carbon steels a high resistance to wear (18 to 20) corresponded with a high hardness number (720), whereas, in manganese steels having a relatively low hardness number (241 to 286), the resistance to wear was extremely high (27 to 30).

In the wear test it was found that the effect of the vibrations of the wearing ring on the wear was very marked, so that it was difficult to repeat the tests. At the suggestion of the Committee, designs for a wear testing machine are being prepared, in which it is hoped that this difficulty will be overcome.—National Physical Laboratory Sectional Report.

QUEER HABITS

PEOPLE engaged on repetition work sometimes form queer habits, which appear to have no useful connection with their work. In a certain shop the heads of hexagon bolts were chamfered in a simple lathe, the bolts being screwed into a cylindrical block or chuck mounted on the spindle. As soon as the screw was tight the workman hit the chuck a resounding whack with a spanner. Both chuck and spanner showed that this must have been done millions of times during the years that the man had been on the machine. No useful purpose was served, but the habit had become automatic and could not be discontinued. The man could give no explanation as to why he did it and the origin of this curious habit remains wrapped in mystery.

A similar case is that of a workman who had to wheel broken stone in a barrow and tip it into a deep excavation for the foundation of a building. After tipping his barrow he would let go the handles and raise his hands above his head with an expression of horror on his face, apparently at the awful fate of the stones.

Radiator and Boiler Manufacture in a Modern Foundry

Staff Article

The production of steam and hot water heating apparatus is a highly specialized development in modern iron founding. Systematic care and increasing attention are necessary for the continued production of satisfactory work.—In the following article a brief description is given of a visit to one of those plants which have earned for Canadian manufacturers in this line, an enviable reputation for quality of product, due to good workmanship and material.

THE No. 3 plant of Steel & Radiation, Ltd., is situated on the outskirts of the town of St. Catharines, Ont., a progressive and flourishing community of over 14,000 inhabitants. The Grand Trunk Railway System supplies convenient transportation facilities and the comparatively close proximity of such manufacturing centres as Toronto, Hamilton, Welland, Niagara Falls, and Buffalo, ensures a favorable market in which to secure labor, materials, etc. The plant, which is comparatively new specializes in apparatus for steam and hot water heating and full advantage has been taken of such methods and equipment as can be adopted where high class repetition work is required.

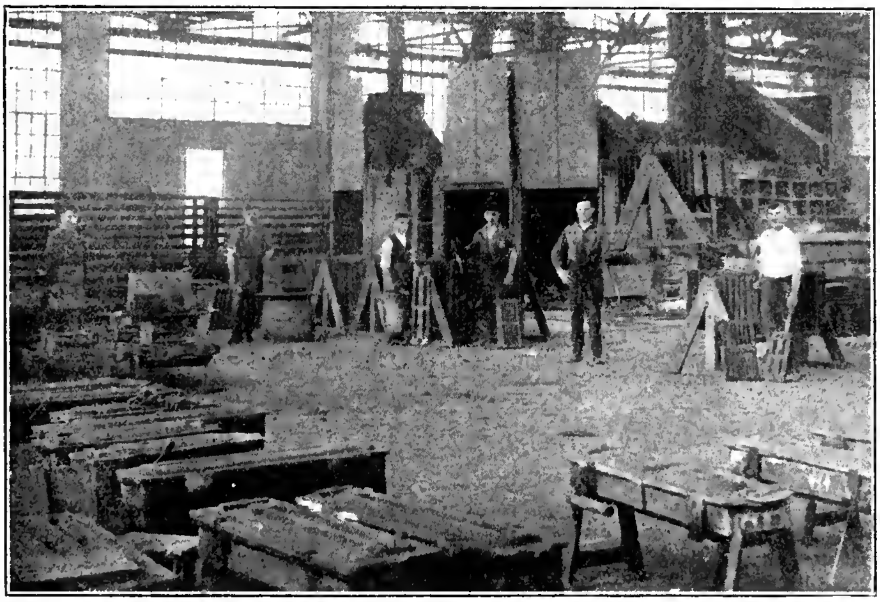


FIG. 1. FINISHED CORE AND CORE OVEN DEPARTMENT.

Buildings

The buildings consist of three principal bays running north and south and connected by a spacious cross aisle. The pattern shop, pattern store, and stock room are separately housed in detached buildings to the north of the main structure. All of the buildings are of modern design, an important constructional feature being the liberal use made of "Fenestra" steel sash, which is manufactured in Canada by this company. The efficiency of this product in providing light and ventilation is widely recognized, and its use, combined with ample height and floor space, provides ideal conditions for foundry operations. With the exception of the moulding department which is paved with brick, the shop has wooden floors throughout and in all respects is thoroughly representative of this particular sphere of modern foundry practice.

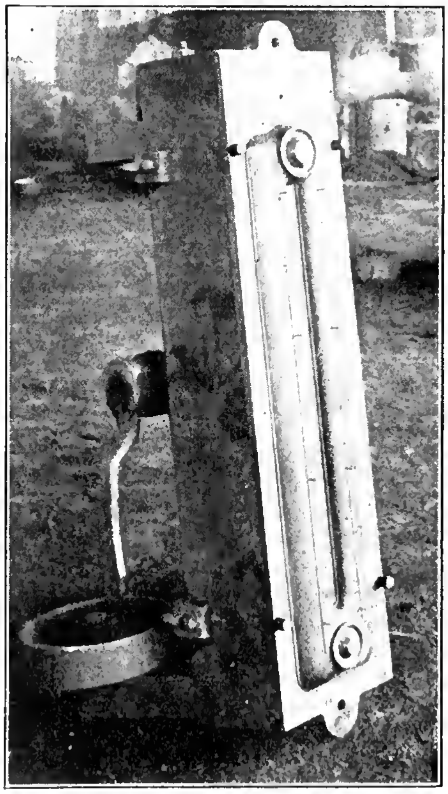


FIG. 2. MOLDING MACHINE FOR RADIATOR SECTIONS.

Raw material consisting of pig iron, coke, sand, scrap iron, etc., is delivered on the railway siding close to the cupola, a suitable covered storage space enabling a stock of material to be kept on hand

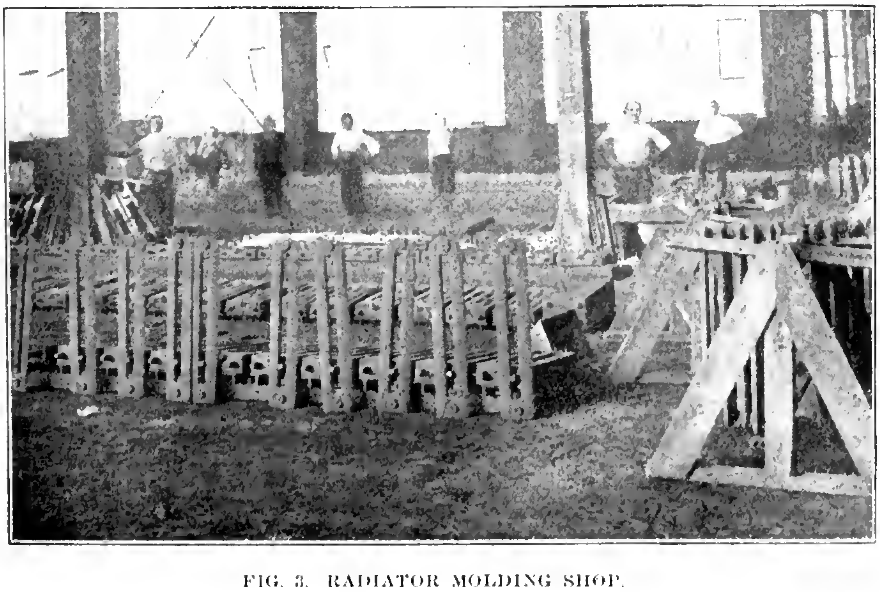


FIG. 3. RADIATOR MOLDING SHOP.

should weather conditions interfere with its handling in the open.

Cupola Installation

The cupola is installed at the east end of the cross aisle and ample space is provided to allow of safe and rapid handling of the ladles. Close to the cupola is the blower room in which is a large "Connersville" blower of ample capacity, belt driven by a 50-horse power motor. Two belt driven air compressors supply compressed air for hoists, etc. The cupola elevator gear is conveniently situated in this room and is operated by a 15-horse power motor. Electrical energy is obtained from Niagara Falls, the shop equipment including a transformer set which supplies 3-phrase 25-cycle current at a pressure of 550 volts.

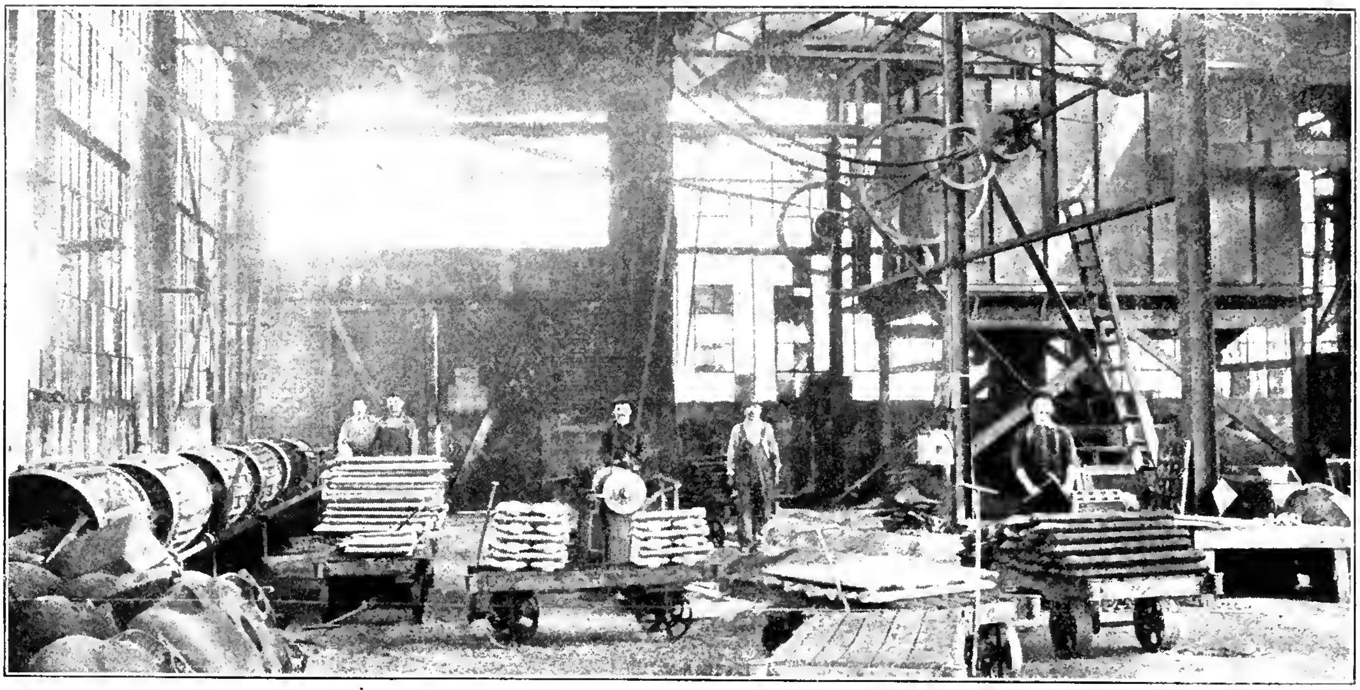


FIG. 5. GENERAL VIEW OF FETTLING SHOP.

Owing to the high grade of work required, metal patterns are used almost exclusively. After the cores are formed of specially prepared sand, they are placed on trucks with suitable bodies and run into the drying ovens. A transfer truck runs on a track across ea... e of the core ovens thus allowing any rack to be put into any oven, and when dried, to be placed in any desired position, in the storage space, where the cores are arranged on frames for transference to the moulding department.

Modern Methods

As would be expected in a plant of this description, moulding machines are largely used, Fig. 2 showing one type of machine which is simple, strong, accurate, and quick. Fig. 3 shows a view in the

FIG. 4. HEATING BOILER MOLDING SHOP.

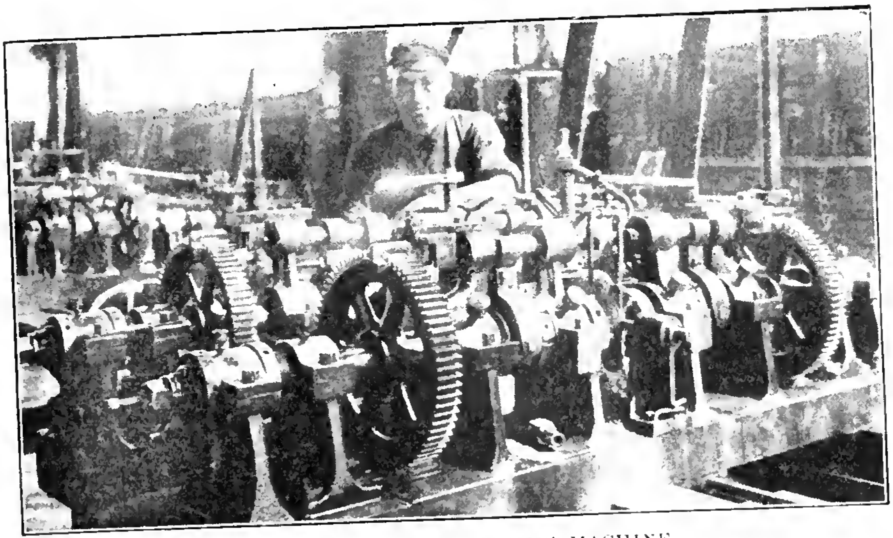


FIG. 6. TAPPING AND FACING MACHINE.

under hydraulic pressure. Specially designed fixtures enable this operation to be accomplished rapidly and satisfactorily.

Although the actual amount of machine work on radiators is not great, it has to be performed with a considerable degree of accuracy. The faces of the bosses which join each other must all be parallel; there must be exactly the same thickness from face to face, and the two faces on either side must be exactly in line. While slight inaccuracies do not appreciably affect a radiator composed of say six or less sections, the cumulative affect of bad machine work on 18 or 20 sections is quite apparent to a casual observer. Special machines which tap and face the four holes of a section simultaneously with the required

moulding shop, it being amply equipped with traveling air hoists, which save considerable time and labor in conveying the ladles of hot metal to the moulds. An overhead electric hoist travels on a track along the cross aisle and is used for transferring work from one bay to another.

A view of boiler moulds in course of preparation is shown in Fig. 4. The number of different pieces required in producing the boilers is greater than with radiators, in addition, the shape of the parts does not allow of the same moulding methods being pursued. As a result of this, the methods in use are similar to those generally adopted in the production of high grade foundry work, skilled labor and the best of materials and equipment being indispensable to the maintenance of the company's standard of excellence. A complete equipment of sand blasting and rumbling machinery is installed, and after being thoroughly cleaned the various parts are tested

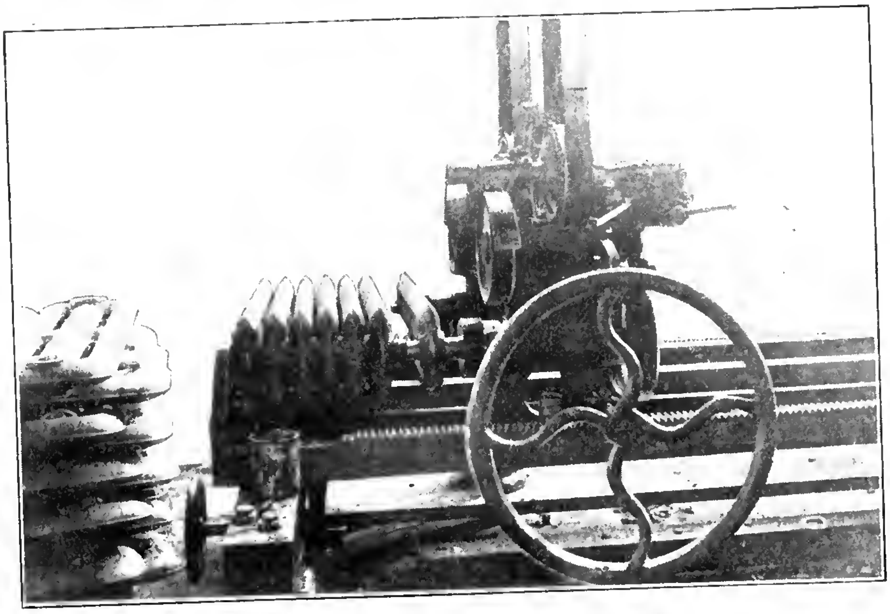


FIG. 7. RADIATOR ASSEMBLING MACHINE.

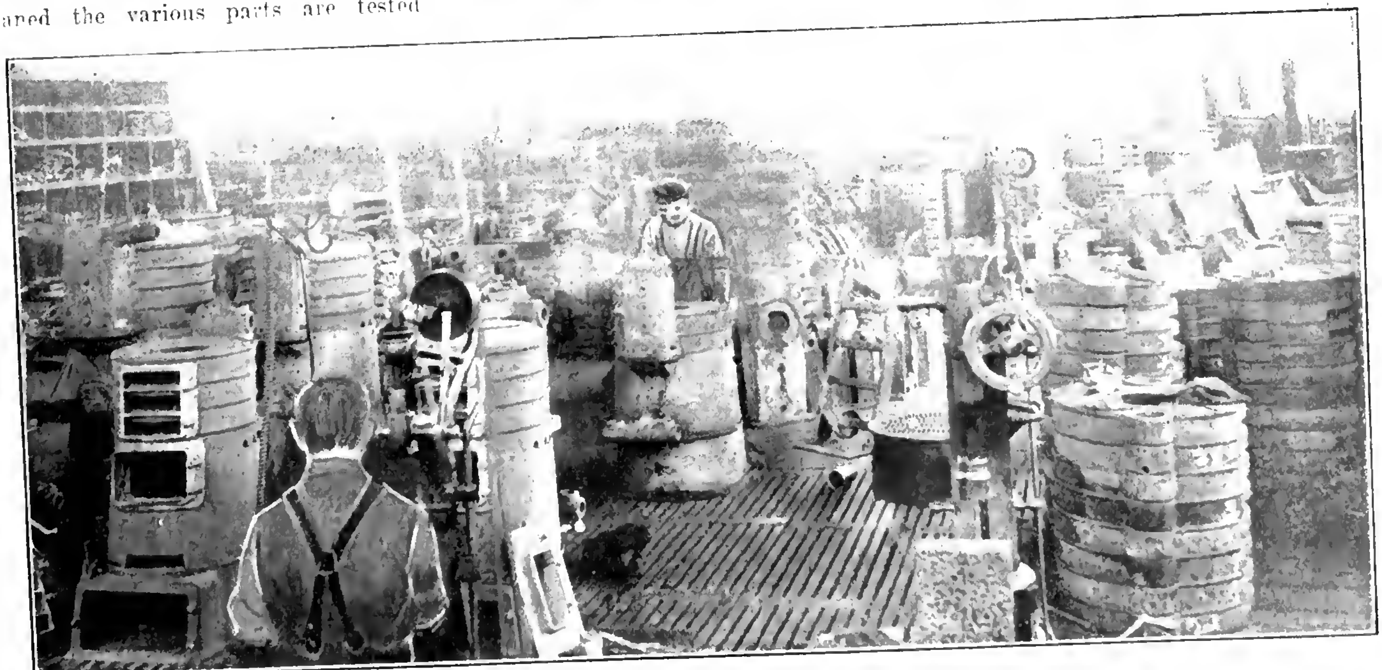


FIG. 8. HEATING BOILER ASSEMBLY DEPARTMENT.

degree of accuracy have been designed and built in the plant.

As can be observed in photograph, Fig. 5, the machine consists of two carriages, each of which carries two spindles. One of the carriages is rigid while the other is adjustable along the ways in the foreground of the picture. The machine shown has an adjustment of from 20 inches to 45 inches between centres of spindles, sufficient to handle all ordinary radiator sections.

Radiator Assembly

The threaded nipple system of construction is used exclusively in the company's radiators, making it thereby possible to produce tighter joints with less possibility of damage to the castings than when the push nipple joint is used. The latter method involves the use of tie rods or braces, which are unsightly when used externally, and interfere with the circulation when used internally. Furthermore, it is an easy matter to dissemble a threaded nipple for repairs, whereas a push nipple joint can only be separated at considerable risk of damage to sound parts of the radiator. As a result of this method of construction, few, if any, sections fail when the final hydraulic test is applied to the assembled unit.

Conditions render the use of push nipples desirable in the construction of steam and hot water boiler of which this firm has a large output. Push nipples of the spherical type as used by the company allow the component parts of a boiler to adjust themselves in use so that undue strains are avoided and all possibility of leakage is entirely prevented.

A well equipped machine shop and tool room are, as might be expected, a necessary adjunct of such a plant, and contribute to that quality of product for which the company have earned quite an enviable reputation.

LAKE SUPERIOR CORPORATION

SURPLUS profits from operation of the subsidiary companies of the Lake Superior Corporation in the year ended June 30 last amounted to $1,366,210, a decrease of $1,145,125, or about 45 per cent. The return does not include any figures from the Algoma Central & Hudson Bay Railway, which went into a receivership during the year, and to that extent the comparison cannot be exact.

The return giving the output of the main company in the group, the Algoma Steel Corporation, reveals, however, the source of the great shrinkage in earnings. "The production of pig iron, rails and merchants' mill material," says the directors' report, "is less than for the previous year on account of the sharp falling off in demand which was experienced towards the end of the year." The output, in tons, compared with the preceding year, was as follows:

	1913-14	1914-15
Pig iron	311,904	212,917
Steel rails	325,680	174,536
Merchant mill material	15,575	8,903

The subsidiary companies, after paying interest on bonds amounting to $1,166,414, writing off $62,000, providing $134,423 for sinking funds, appropriating $54,209 for reserves and paying to the holding company $342,859 as interest on bonds, etc., showed a deficiency of $393,695 for the year. This wiped out the $61,930 carried as unappropriated profits and left a net deficiency of $331,765 at the end of the year.

The total income of the holding company, Lake Superior Corporation, was $369,032, against $448,054 the previous year. After paying interest and expenses the balance remaining as net income for the year was only $1,661.

MELTING FURNACE DATA

IN the course of a paper read before the British Foundrymen's Association, F. C. Barker referred to the various forms of tilting type coke-fired furnace, both those heated on the regenerative system and ordinary firing. He specified one of the former in which the furnace body consists of two light steel shells, one within the other, the grate-bars being carried within the inner body and a preheater being fitted above. The working results for this furnace are given for the 400 lb. size as follows:—Time of melting 8½ hours; average metal to coke 5 lb. or 6 lb. to 1 lb.; life of crucible 60 heats.

For another furnace of the same general construction, but without pre-heating for the air, the following results were attained from practical foundry working over a period of 12 months:—450 lb. size furnace, average life of crucible 50 heats, coke consumption 4 to 1; 250 lb. size furnace, average life of crucible 60 heats, coke consumption 6 to 1.

Compared with coke-fired pit furnaces, these tilting furnaces show a saving of 50 per cent. in crucibles, and 50 per cent. in coke, while the amount of ash, owing to the better combustion of the fuel, is less by 80 per cent. The first-mentioned of these furnaces can be adapted to burn crude oil.

Oil fuel has several distinct advantages. The furnace can be started up directly the oil and air jets are opened up. One man can look after several furnaces. There is no cleaning out of the furnace at the end of the day, and little storage room is required. The furnaces require no stoking or poking, and the melting can be conducted in a reducing atmosphere. A long life is assured to the crucibles, and a wide range of temperatures can be obtained.

GOLD OUTPUT INCREASES

THE Department of Mines reports that the total gold output in Ontario for the six months ending June 30, 1915, amounted to $3,570,072. Last year the value of the output was $2,011,069. Of the total yield for the half year, $3,267,620 was mined in Porcupine. This shows that the output from the Porcupine mines is growing, and if maintained will show a 50 per cent. increase over the yield for 1914.

The department reports progress in many of the mining districts, and says that the prospects for a large output of gold ore from these mines are very bright. Some of the mines mentioned are: The Huronia at Kirkland Lake, Goodfish Lake camps, Munro camps, Howard's Falls (Kow Kash).

The output of silver continues to diminish. There is a difference of $1,864,655 between the output of 1914 and the decreased output for the half year of 1915. Nickel has been mined more extensively. Compared with the previous year, the value of the nickel mined has increased 18 per cent., and that of copper 2 per cent.

The figures for the six months in 1915 and 1914 are, respectively: Gold—$3,570,072, $2,011,069; silver—$5,188,763, $7,053,418; copper—$1,229,894, $1,197,059; nickel—$3,393,528, $2,872,843; iron ore—$288,296, $118,119; pig iron—$2,856,040, $4,429,664; cobalt—$34,443, $22,581; cobalt oxide (including nickel oxide)—$56,812, $379,152.

Experience.—A graduate should emerge from the engineering school possessed with intellectual humility rather than intellectual arrogance, and should realize that without experience his engineering judgment will be of little value. —Professor Swain.

Studies.—No man ever gained much from studies pursued for the selfish purpose of broadening himself out, without some definite relation to his usefulness as a citizen. We have an example of futility in the literary education pursued in China for 2,000 years, with no possible relation to the students' subsequent careers. If a student's inner motive is not greater power for the service of others, his education is a flat failure and his satisfactions are barren of happiness.—Professor Adams.

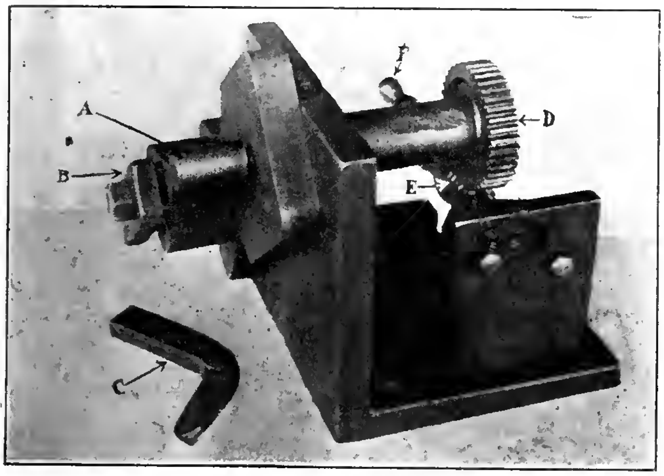
PRODUCTION METHODS AND DEVICES

A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

SHAPING CIRCULAR PIECES

By G. E. Luck

A USEFUL device for machining circular pieces on a shaper is here shown. The piece shown at A is a rocker for a small punch press, though any similar piece may be machined in the same way. This rocker has a hole bored in its widest part for the crank pin, and this bored hole is used to locate by, as it is set over



SHAPING CIRCULAR PIECES.

a large pin inserted in the holding plate. The clamp B holds the work securely in place. A pointed pin in the holder-plate marks the centre of rotation and a punch mark in the piece to be machined is set over this pin in order to line up properly for the cut. The cutting is done with an extension tool like that shown at C. The holder-plate is attached to a spindle which has the gear D on its opposite end. A worm E meshes with the teeth of this gear, so that as the ball crank F is slowly turned, the work is revolved under the cutter. Once set, work may be machined about as rapidly in this way as ordinary flat work.

SUGGESTION FOR CUTTING SPIRALS

By S. Leeman.

I WAS very much interested in reading Mr. Miller's suggestions in your issue of Sept. 9 for cutting spirals.

Suppose we were cutting spiral grooves 6-in. lead and ¼-in. deep in a 1-in. piece, then according to his method of laying out or unrolling the piece, we would have a rectangle 6 in.×3.1416 with a groove diagonally across from corner to corner. Now, 3.1416 ÷ 6 = .5236, which is the sine of the angle between the diagonal groove and the side of the rectangle. Looking this up in a table of sines we get 31° 35′.

Let us now unroll the circle made by the bottom of the grooves where it is only half the diameter, and we get a rectangle with a height of 6 in. and a base-line of 3.1416 ÷ 2 = 1.5708. Again, 1.5708 ÷ 6 = .2618, and the angle corresponding to this is 15° 11′.

Now, if Mr. Miller has a cutter cutting an angle of 15° 11′ at one part of the groove and 31° 35′ at another, to which angle does he set his miller?

Another point in the article which is not very clear to me is where he says the difference in the length of the base-line and the upright line is the ratio between the turning gears and the feeding gears.

If Mr. Miller means that the ratio between the length of the two lines is the same as that between the revolutions of the two gears, he is hardly correct, for as I have shown, we may get different rectangles, giving different ratios, from different diameters and yet having the same lead produced by the same gearing.

If we call the base-line in all cases one, to represent one revolution of the work, and multiply it by 40 to get the revolutions of the gear necessary to revolve the work once, and we multiply the height of the rectangle, 6 in., by the pitch of the table screw, usually 4, to get the revolutions of the screw necessary to traverse the work that distance, we get 40 and 24 as the gears to use, or 5 to 3 as the ratio of the gearing; but as the table screw must turn fewer times than the worm, we must put the larger of the gears on the screw and the smaller on the index head.

INCREASED PRODUCTION ON MARKING MACHINE

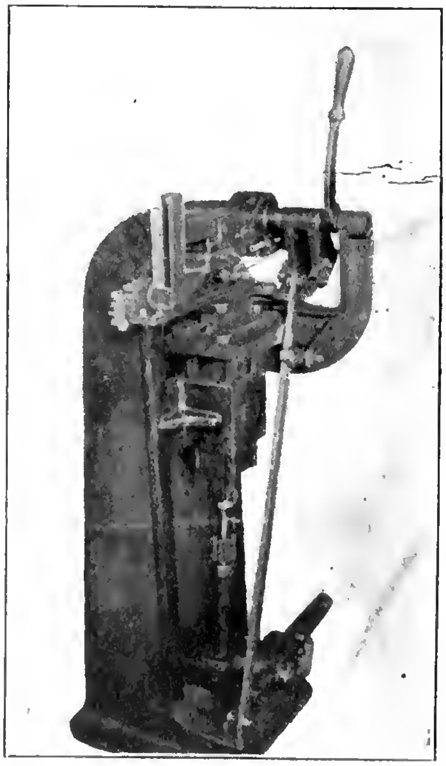
By D. A. Hampson

A MACHINE that was little known in most quarters before the recent manufacture of munitions was begun is the Dwight Slate marking machine. It is made in two styles—one for marking cylindrical work, and one for marking flat work. We had used one for years and not many months after the war's inception found it over-taxed and considered purchasing another.

The work that was wanted most was the marking of vast quantities of a steel piece that for all practical purposes may be considered as ⅛ in. x ¾ in x 1¼ in. These came to the machine more or less oily which, added to their thin shape, made handling difficult and production aggravatingly slow. Some study of the problem convinced the writer that improvements could be made—accordingly the work was done, and it fulfilled all expectations.

The Improvements

The photograph shows the machine as "improved." An extension on the table carries a vertical feeding chute that holds sixty pieces. To the horizontal slide (which carries the roll stamp) will be seen fastened a casting extending past the chute; it has, at its lower side, a dog which pushes out the bottom piece of the pile. The handle has also been changed from the back to the front of the machine, the pinion shaft lengthened, and provided with an outboard support. Further, the shaft drives a casting having an



IMPROVED MARKING MACHINE

internal runway for the two rollers that will be noted at the upper end of the diagonal bar. This bar raises the work table instead of having it done by the foot of the operator. The rollers drop

off the runways at the end of the stroke and the table returns by gravity. One end of the runways is hinged—as may be seen—this permits the return and the drop into position, ready to pick up the rollers for a new stroke. So arranged, a complete stroke of the handle feeds a new piece to the stamp, raises the table, marks the piece, and returns all parts to the starting point.

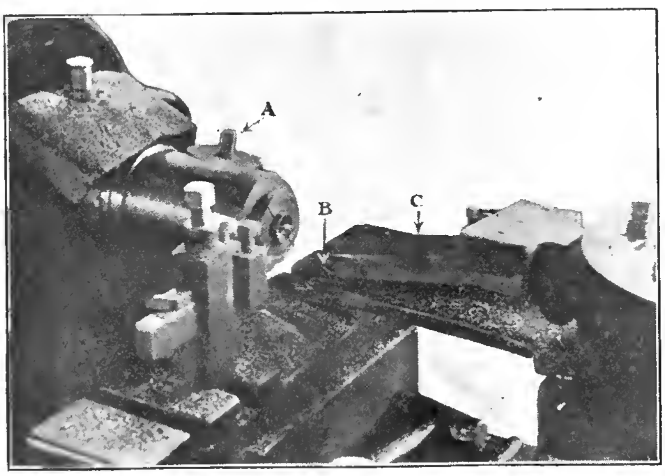
Reduced Labor

After loading the chute, the operator has but one thing to do—move the handle—as the pieces are confined in a trough that leads out at the back into work boxes. Relieving the operator of the mental and physical exertions of a hand movement, or foot movement for unloading, and for most of the loading increased the production two hundred per cent. A less skilled operator now does the same work and congestion no longer exists at the marking machine.

A TURRET CROSS-SLIDE FEED

By A. E. Granville

IN machining the piece shown at A, it is chucked by the stem and faced off. Being considered easier for the operator, and less liable to throw chips in his eyes, a cross-slide feed was made to be operated by means of the turret capstan. This was done by placing a hardened roller on the cross-slide at B, and a diagonal slide C on the turret. From this it will be seen that as the turret is fed toward the chuck, the cross-slide will be forced to move toward the back and carry the cutting tool across the face of the work. As the turret is run back a spring pushes the cross-slide toward the front and clear of the work.

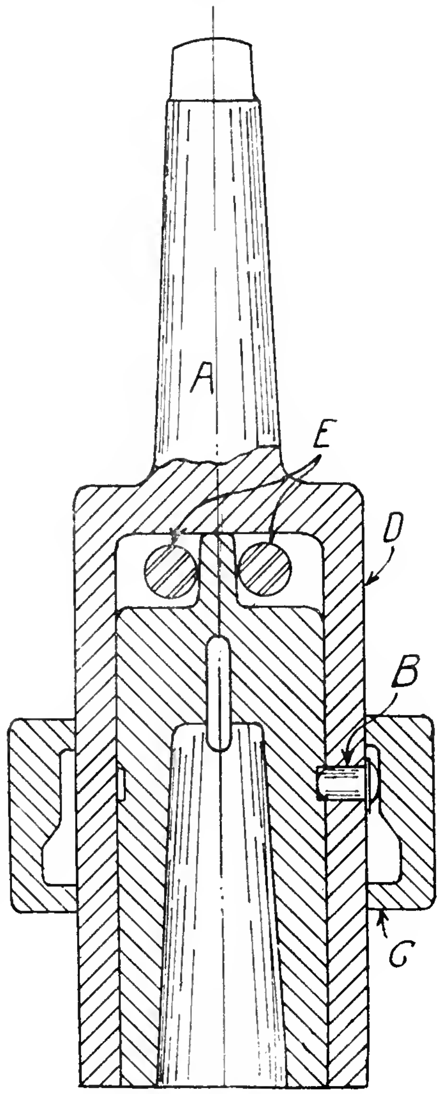


TURRET CROSS SLIDE FEED.

A SIMPLE DRILL CHUCK

THE removal of drills from their sockets by means of a drift is at best a poor method. This is especially true when used on multiple-spindle drills. On these machines, since there are several drills in simultaneous action, the waste of time required in removing one by the old method is indeed quite costly.

There are several drill chucks on the market which allow the drill to be removed while the machine is in motion, and that here described and illustrated is among the simplest we have seen. The chuck body A has a tapered shank which fits the machine spindle. Through the chuck body is fitted the pin B, and this pin is operated by the sliding collar C. After the pin has been fitted in place, the collar C is slipped over ,this being accomplished by means of a slot in bottom face of the collar. Through the top of the body are fitted two circular pins E. These engage with the tang of the adapter, thus driving it. The adapter D is pushed up into the body of the chuck when the collar is in its top position and is held in place by means of the pin B engaging with the annular groove machined on D.



A SIMPLE DRILL CHUCK.

From the foregoing the operation of the chuck can be easily followed. To remove the adapter from the chuck body it is only necessary to hold it lightly in one hand while the other pushes up the sliding collar. This allows the large diameter of the bore to come opposite the head of the pin B. A slight downward pressure on the adapter causes the pin to slide out from the groove, thus leaving the adapter free to be removed. With this appliance it is advisable to carry a full line of adapters bored out for the complete range of drills. Where this chuck has been used it has been found to give complete satisfaction.

SHRAPNEL SHELL SOCKET TOOL

By Geo. Armstrong

NO doubt several manufacturers in the shell industry have found more or less difficulty in securing a suitable apparatus for screwing the fuse sockets into place, or in removing a finished socket from the shell without marring the same. The latter is often necessary and must be done in order to rectify faulty weights. When the shells are finally inspected, they are often found to be under weight and in order to bring them to the desired standard it is necessary to remove the brass socket and place shot in the shell, till the correct weight is reached.

The tool described in this article is one that has been found to give entire satisfaction for this particular feature of the work. Referring to Fig. 1, the stud is turned from the solid and is made in two diameters, the larger diameter being threaded 14 threads per inch, R.H., to fit the thread in the fuse socket. The thread pitch of the smaller diameter is the same but the thread is left hand. A square head is milled on the top of the thread, and is made to fit a standard size wrench. The L.H. nut is made as shown in the sketch, the large diameter being bored to a bevel similar to that of the outside diameter of the fuse socket.

When it is required to screw a semi-finished socket into place, the nut C, Fig. 2, is first run back a sufficient distance in order to allow the larger thread to be screwed into the fuse socket, and within two threads of the bottom. The nut C is then turned back till it binds against the top of the socket. A wrench is placed on the head D of the stud and is turned to the left, or in the direction required to screw the R.H. thread. The action of the right and left hand thread is to bind the nut C, and the fuse socket tightly together. The fuse socket, nut

and stud then screw down as one unit till the shoulder of the fuse socket binds against the shell. To remove the tool, all that is necessary is to put a wrench

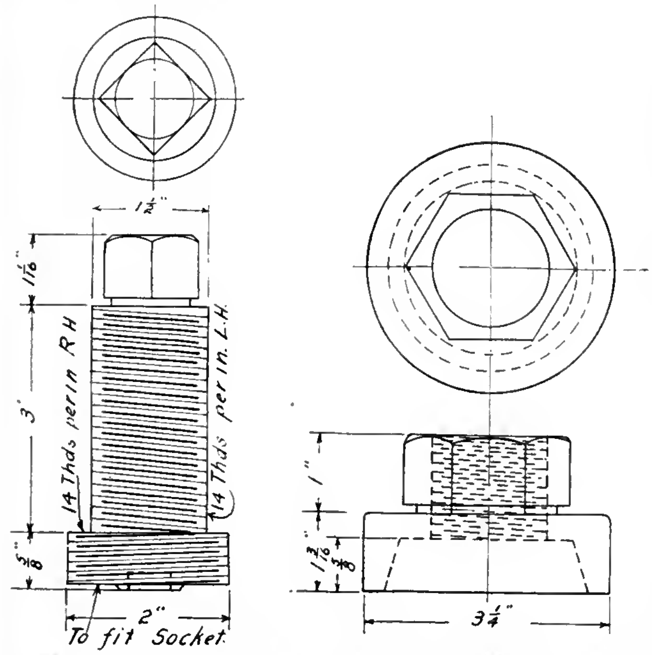


FIG. 1. STUD AND NUT FOR SHELL SOCKET TOOL.

on the nut C, and loosen it by turning to the left, at the same time holding the stud stationary with the other wrench. The plug, thus released, can be easily screwed out of the socket.

The removal of a finished socket from the shell is done in the manner illustrated in Fig. 2. The plug A is screwed into the socket to within one thread of the bottom and the nut C is brought

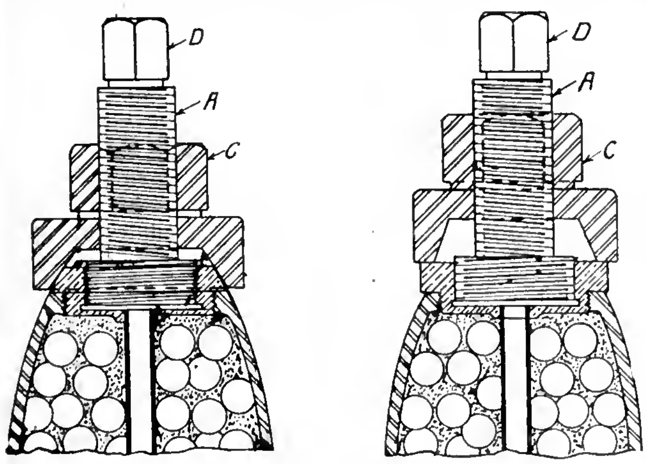


FIG. 2. APPLICATIONS OF SHELL SOCKET TOOL.

down against the socket, a wrench being then placed on the nut C, and turned to the right. The action is similar to the previous arrangement, the right and left hand threads again having the tendency to bind both the nut and socket together, thus allowing the latter to be withdrawn. The tool is removed by the socket in a similar manner as already stated, that is, a wrench is placed on the head P, and is held stationary while the nut C is loosened by the other wrench.

BELLOWS and Tilt Hammers.—An inquiry into the evolution of the bellows would yield some valuable information on the steps through which metal working progressed in the past centuries. In the small, but little known, museum at the Record Office in Chancery Lane, there are two sixteenth-century drawing attributed to Lord Burghley. They illustrate a phase of lead-smelting in Derbyshire. One, described in one corner as the "Old Order," shows two men each standing on a pair of bellows, the nozzles of which are directed towards a furnace. The other picture, inscribed "Burchardes Furnise," is quite elaborate. There is a rough representation of a water-wheel outside the wall, with gear connecting to an overhead shaft of wood in the smelting-house. Four bellows are shown attached by as many connecting rods.

Mr. Charles Dawson, of Lewes, has a photograph of a clock-face made at Ashburnham, which was the centre of one of the Sussex ironmaking areas. The dial shows in a quaint fashion some of the phases of the industry: digging the ore, cutting down the trees, charcoal-burning, the interior of the forge, the foundry, and even the checkweighing of the cannon and other output of the works. The picture is the only contemporary representation of a Sussex ironworks of which I have any knowledge.

With regard to tilt hammers, Mr. Lewis, another Sussex antiquarian, suggested that the original tilt hammer was merely pivoted a little out of the centre. There was a free end opposite the tup, on which one or two men stepped to raise it. When they stepped off, the blow fell on the metal on the anvil. Afterwards the blow depended upon a cam, or the sprocket of a star wheel on the waterwheel shaft. Sometimes the pressure was exerted on the top of the free end of the hammer beam, at others under the beam between the pivot and the tup. By these primitive means a good merchantable bar of useful length was hammered out of the bloom. It is on record that as early as 1300 the farrones, or ironmongers, of London were agitating against the Sussex ironmasters, who were delivering iron bars so short that making tyres for cart wheels was rendered difficult.—Practical Engineer.

A NOTABLE Event in Foundrydom.—What might be termed the "modernization of the foundry" has been effected almost entirely within the past twenty years, as it is during this period that the greatest advances have been made, not only in the purely mechanical end of the business, the production of castings and methods of melting and mixing of the metals, but in easing the lot of the worker and making the foundry a more desirable place in which human beings shall live their working hours. In place of the dark, damp, unventilated and unheated frame buildings of the past, we now have fine structures of steel, brick and concrete, lighted by large arc and incandescent lamps at night. The various improvements that have been made are too extensive to be enumerated, even were it necessary; they have extended to all branches of the foundry industry, as every foundryman is well aware whose active career has covered the period in question.

These changed conditions are primarily due to the great educational movement that had its inception in the formation of the American Foundrymen's Association twenty years ago; the most notable event in the history of founding, an event that could hardly fail to result in good to the entire trade, for had little else been accomplished other than to bring foundrymen together to become acquainted with each other and with the men who furnish the supplies and build the machines, the formation of such an organization would have been well worth while, for once foundrymen got to know each other, distrust vanished, and it did not take long to discover that none had a monopoly of foundry knowledge, and that mutual advantage resulted from discussing with each other the various problems and difficulties encountered and the manner in which they were solved or surmounted.—Brass World Editorial.

Correction.—In our issue of August 26th, describing the Lea Simplex Cold Saw the statement was made that "the stock . . . is moved far enough ahead to cut possibly within one-sixteenth of an inch of the finished length." This is quite in error. The makers of the machine guarantee that by means of this gauge plate, "stock is cut to the exact finished length, and absolutely square."

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Machine, Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

NEW PLAIN-TURNING LATHE

UNDER usual circumstances, the plain-turning lathe as such, because of its elementary simplicity would probably not be looked upon as a highly economical manufacturing machine for a shrapnel or projectile shop; but an analysis of its feeds and speeds in their improved forms, and of the manner in which the machine does its work, will show to what extent improvements in its design have made it a manufacturing tool of high rank.

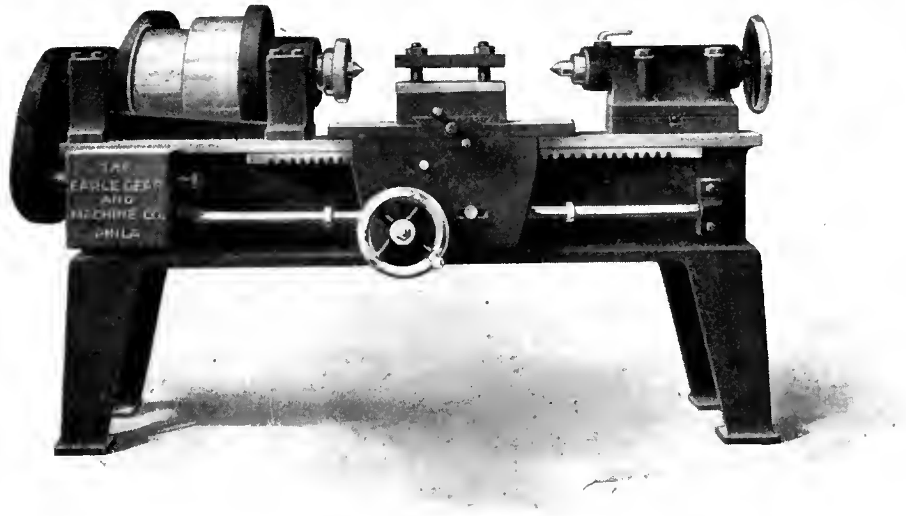
The accompanying illustration gives a good idea of the general character of one of these lathes, as made by the Earl Gear & Machine Co., Philadelphia, builders of the "Lea-Simplex" cold saws. The machine shown here happens to be one with a two-step cone and back gears in the headstock, the swing being 18 in. over a 7 ft. bed. Where preferred it may be had with a variable speed motor, direct connected to the spindle through gears. Other sizes of 20 in x 8 ft. and 24 in. x 8 ft., are also built, and being much heavier and more substantial, are obviously fitted for heavy work such as 4½ in., 6 in., and larger shells.

Everything is arranged for the rapid and easy execution of the various operations. Questions of spindle alignment are avoided in the method of construction. The popular compound rest for the tool post becomes unnecessary, for the simplest form of cross-slide on the saddle will do everything the machine is intended to do.

The turning of the shell nose requires the addition of a forming attachment milled to the contour of the nose. For this operation the headstock spindle is recessed deeply enough (at a diameter larger than the maximum shell the lathe is intended to take) to allow about four and four and one-half inches of the shell to enter. This leaves about four inches for the chuck grip, and gives the lathe tool unrestricted access to the nose. These lathes also take the French 75 m.m. shell.

As the illustration shows the machine is quite simple in design—and its sturdiness is evidenced in the different parts visible in the picture.

The bed which is seven feet long, is cast in one piece with the headstock. This carries with it several decided advantages. In the first place, it establishes permanently the parallelism between headstock spindle and bed; furthermore, it assures alignment of the carriage and tailstock with the headstock spindle. The unusual width of the bearing surfaces of the bed make more than a single "V" unnecessary, the purpose of this being to take up reactions occasioned by the lathe tool.



NEW PLAIN TURNING LATHE.

The greatest distance between centres is 28 inches. The swing over the bed is 18 in. and 10 in. over the carriage. The height from floor to horizontal centre is 40 inches. Much attention has been given the design of the bearings. The front and rear spindles measure 5 in x 6¾ in. and 4½ in. x 5½ in. diameter and length respectively, and are of the ring oiling type. Governed by these dimensions, the diameter of the tailstock spindle was made 3½ in. and given 6 in. travel.

The carriage, which is power driven has long and wide bearings on the bed. This makes movement by hand very easy, and of course utilizes but little power when moving under power feed. Feed changes are handled through slip gears, plunger controlled, which are in a gear box attached to the head end of the bed. A considerable variety for different metals is achieved by the combination of gear box feeds and spindle speeds. In the belt-driven machine, with two-step headstock cone, the combination with the two-speed countershaft gives eight spindle speeds, or 24 combinations of feeds and speeds, of which the highest is 68 feet per minute. Of course, the eight-spindle speeds include the two back-gear speeds, which are produced through gear ratios of 5¼ to 1. Naturally, the machine with variable speed motor drive may be made to offer more than 24 combinations.

One of the most interesting features of the machine is the headstock spindle, which is furnished either solid or bored, as specified. When it is fitted with a face plate, it takes a No. 5 Morse taper (as does the tailstock). This spindle is bored only when it is to be used in taking nosing operations. A one-inch hole passes through the entire spindle. This makes it tubular, and adds very much to its stiffness, reducing weight at the same time. At the face plate end, a larger hole is recessed into it in a way that provides: First, sufficient depth for any length of shrapnel shell having a diameter within the machine's capacity; secondly, sufficient bearing surface for the chuck jaws, assuring an absolutely tight and vibrationless grip, without digging into the stock; thirdly, the required amount of protrusion beyond the chuck jaws to permit complete nosing with one setting; and, fourthly, minimum overhang beyond the chuck, which prevents chattering and assures smooth, accurate work.

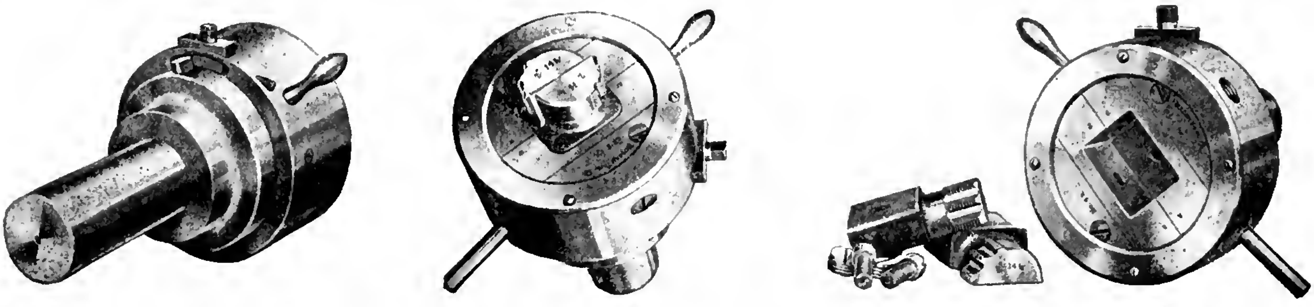
NOVEL COLLAPSIBLE TAP

THIS collapsible tap has been developed by the Modern Tool Co., Erie, Pa., and is designed to meet all requirements of internal threaded work.

As will be observed in the illustration, the tap proper is formed in two halves, being similar to an ordinary solid tap split along the centre line. Instead of having grooves cut at equal intervals around the body, the grooves are confined to opposite sectors of the two halves and are made fewer in number. The shanks of these tap-chasers, as they should be termed, terminate in the form of a square of generous proportions. These square ends are made a push fit in

the recess formed in the chaser blocks which slide in opposite directions, each block moving its chaser across the face of the other chaser.

By confining the cutting teeth to a suitable portion of each chaser, the device immediately assumes all the characteristics of a collapsible tap, the blank surface on each chaser allowing them to be brought toward the centre to withdraw the teeth from the thread. The chaser-blocks slide in a tap head which in turn is driven in a positive manner by the shank. The action of the mechanism is controlled by a cam ring and suitable means are provided for automatic release, resetting, and adjusting to size.



"MODERN" ADJUSTABLE COLLAPSING TAPS, SHOWING FRONT AND REAR, ALSO TAP WITH CHASERS REMOVED.

This tap is suitable for use on the various makes of screw machines, turret lathes and other tools where the tap is stationary and the work revolves. It can also be applied on machines where the work is stationary and the tap is revolved, a simple device for closing the tap automatically as it revolves, being easily attached.

The "Modern" collapsible tap is built in four sizes having a range as follows:

No. 1, having a capacity from ½ in. to 1 in.

No. 2, having a capacity from ¾ in. to 1⅜ in.

No. 3, having a capacity from 1¼ in. to 1¾ in.

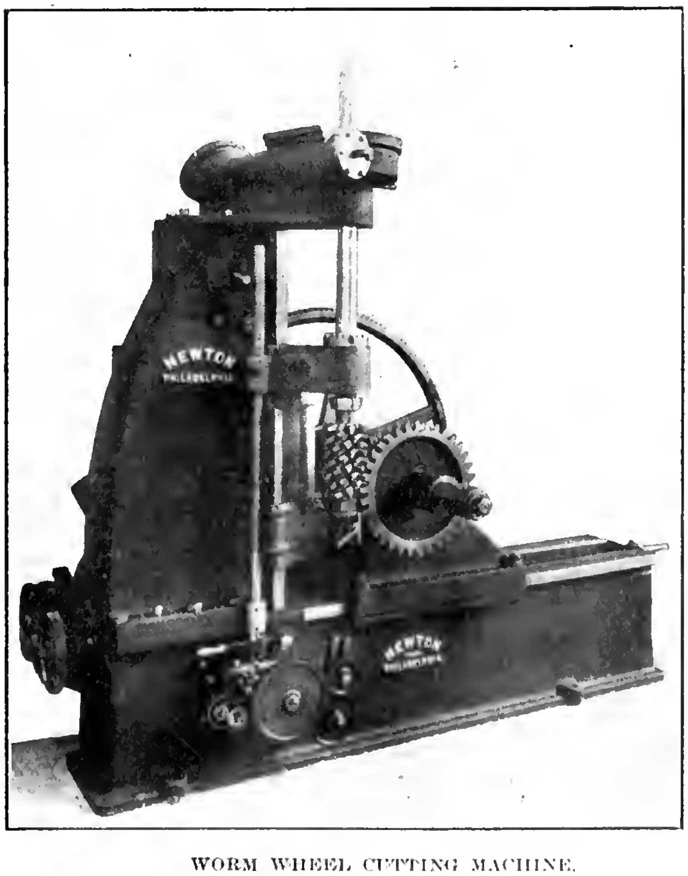
No. 4, having a capacity from 1¾ in. to 3 in.

WORM WHEEL CUTTING MACHINE

THE accompanying illustration shows a new worm wheel cutting or generating machine now being placed on the market by the Newton Machine Tool Works, Philadelphia, Pa. The wheel is cut by either fly cutters or a taper hob. The cutter or hob has the form of a tap and is set to the same distance of axis between worm and wheel and the same angle to the plane of wheel at which the worm actually runs. These measurements remain unchanged during the entire process of cutting.

Contrary to the practice generally followed to cut the teeth of wheel gradually deeper by feeding the cutter in a radial direction to the wheel centre, the cutter in this process is fed at a tangent to the circumference of the wheel, thus cutting first with the tapered end into the solid metal. The teeth of the wheel will become gradually deeper as the cutter, while being fed across the surface, grows larger in diameter, the full end finishing the teeth.

A large worm wheel having 92 teeth, triple lead, 47½ inches outside diameter, 5½ inches face, and of 2 diametral pitch was cut in ten hours.



WORM WHEEL CUTTING MACHINE.

INTERNATIONAL NICKEL

IF the Germans are not securing all the Canadian nickel they want direct, they are not neglecting any ways by which they may secure it indirectly. Mr. Cochrane, a New York millionaire, had built for him the finest and largest power yacht afloat at a cost approaching a million dollars. The hull was an experiment in yacht building, being composed of monel metal, a nickel compound put on the market by the International Nickel Co., and named after its president, Ambrose Monel. Hundreds of tons were used in the construction. Unfortunately it proved a failure. The metal would not withstand the action of the salt water, and after about three months the yacht leaked so badly that Mr. Cochrane sent it to the scrap heap in Boston. As it was being broken up, two Germans arrived from Washington and began negotiations for its purchase. Arrangements were made for repairing the vessel and the adding of large additional quantities of nickel wherever possible. The agent explained that the matter had been discussed at Washington and began negotiations for its purchase. Arrangements were made for repairing the vessel and the adding of large additional quantities of nickel wherever possible. The agent explained that the matter had been discussed at Washington, and it was arranged that, being an American pleasure yacht, it could cross the ocean under the Stars and Stripes, and sail into a German port with an American crew without interference from the Allies. The boat in question is the largest sailing yacht afloat, and undoubtedly hundreds of tons of nickel could be worked into the hull and used as ballast and for other purposes, and thus evade the scrutiny of British and French naval scouts. How much more Canadian nickel may have got to Germany by these indirect methods it is hard to say.

London, Ont.—The city council have decided to purchase five machine guns at a cost of $5,000.

How to Keep Men in Your Employ? A Possible Solution *

By W. A. Grieves **

The necessity of hiring an extra percentage of help in order to maintain the required number of men up to a proper standard is and always has been a source of considerable loss to large employers of labor. The writer clearly explains how one firm avoided this loss and at the same time contributed not a little to the material welfare and happiness of employees.

If you are a manufacturer employing 2,200 men and are shown that it costs you, on an average, about $88,000 more each year than it should, to maintain this force, you are at once interested. At the Jeffrey plant, methods have been adopted for meeting this problem with favorable results and the principles that have been applied can be adapted to other concerns.

Thinking our experience might be abnormal, we sent letters to 40 manufacturing concerns, in the middle west. This letter told how we had been able in five years, by adopting different methods, to reduce the cost of maintaining our force by $24,000 per year.

Fifty per cent., 20 firms, replied and gave their experience for the past year. Others wrote that their experience had been so bad, they felt diffident in putting it upon paper. The replies of the 20 firms revealed that to keep an average force of 44,000 men at work, during the year. they had employed 69,000 men.

Why Men Quit

If more care and thought were exerted to find out why men quit their jobs so frequently, this condition could be improved, and there would be a larger balance on the credit side of the ledger at the end of the year. A certain percentage of any force will change, including loss by death, 1 per cent.; by sickness, 5 per cent.: through removal, 10 per cent., and through mistakes in selecting the right man for the right place, 25 per cent. To maintain an average working force of 44,000 men. taking the foregoing percentages, only 18,000 should have been hired. Instead, 69,000 were hired. or 51,000 more than can be accounted for.

To arrive at the financial loss, group the employes into the following classes:

1—Highly skilled mechanics.
2—Semi-skilled mechanics.
3—Helpers and handy men.
4—Laborers.
5—Clerks.

Then distribute the cost as follows:

1—Expense of employing.
2—Time loss in giving instructions.
3—Breakage of tools and machinery by new men.
4—Spoiled work.
5—Decreased production.

Analyzing these five divisions, their cost in dollars is secured. The clerical work in hiring and discharging men is the least expensive. This cost can be placed very conservatively at 50 cents per man. The instruction expense depends largely upon the nature of the work and the skill and experience of the new employe. The unskilled laborer will cost from $1 to $2 each, for instruction. Experiments in our machine shops show that $10 is not too high for the average skilled mechanic. It is reasonable to figure the expense for semi-skilled men at one and a half time this amount. Helpers and handy men will require at least $5 for instruction; while training new clerks will add a few more dollars. Experience shows that the total cost of instruction can be conservatively placed at $20 per man.

The cost of increased wear and tear and damage done to tools and machinery is difficult to determine, but is about $1 for the highly skilled mechanic and from $7 to $10 for helpers and handy men, an average of $7.

Loss due to reduced production is undoubtedly the largest item. Our experience has been, that mechanics after six months in our employ will gain an average of three to five hours' time per day, while the average new mechanic takes from one month to three months to be able to meet the time limits. At the average wage of 35 cents per hour, the old men gain four hours per day. At 50 per cent. of the day rate, the gain is 70 cents per day. As these men have also saved a like amount for the company, in one month of 24 working days, the company loses $16.80 per man. If the average period during which time is lost by the new men is placed at two months. the loss totals $33.60 per man for decreased production.

The expense incident to spoiled work also is hard to get at, but is at least $15 for skilled and semi-skilled mechanics and $5 for handy men and helpers.

These losses total $81.10 per man. To be conservative, reduce this to $40 per man average. For each of the 20 firms, averaging their employes at 2,200 men each. this means $88,000 of unnecessary expense, or $1,760,000 for all of them. And we have not counted the increased overhead. These figures clearly indicate the need of greater stability of employment in our industrial institutions.

Salesmen vs. Workmen

Industry is composed of two major divisions, producing and selling. What has been your attitude toward the inefficient salesman? In some cases you discharge him. Generally you are no better off. In replacing him, you take the same chances of getting one just as inefficient. Therefore, you reason that the best solution is to educate the salesman. Why not do the same in the manufacturing departments?

The first plan of attack should be through education. The better educated a man is, the more ground for believing that he can be reasoned with. As an example, while conversing with one of our best paid and highly skilled mechanics, recently, he remarked that the company must make an enormous profit on a certain product. Material and labor costs were the only two elements he had considered. Of the immense overhead burden, such as sales, expense, supervision. upkeep, insurance, interest on investment, advertising, etc., he was entirely ignorant.

Is it any wonder that such men fall easy victims to the misleading arguments of the selfish and unprincipled labor agitator? The trouble rests with the manufacturers. They have allowed themselves to be advertised by those who do not know — allowed themselves to be shown wrong side up.

Do your men know that if you make money this year. it probably will go into new machinery and equipment next year? Do they know that through changes in design, this new machinery may be good only for the scrap heap next year? Do they know that during periods of depressed business, you are compelled to take work below cost, simply to give them work and hold your organization together? Do your men know that while you are eager to pay higher wages. provide better equipment, and have more ideal working conditions, you are restrained by competition? You are willing to pay $5 per day to mechanics, but others may pay only $3 per day. Do your employes know this?

In the Jeffrey betterment policy, we

(Continued on page 71)

*A paper read before the Detroit Board of Commerce.

**Assistant secretary and supervisor of welfare. Jeffrey Mfg. Co., Columbus, O.

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INDUSTRIAL SIGNIFICANCE OF MODERN ENGINEERING DISPLAYS

THE Panama-Pacific Exposition is now entering on the final stage of its career. The success which has attended its limited life is as gratifying as it was unexpected. In spite of the seeming lack of support accorded it by foreign governments, on whose active participation in the event considerable expectations had been built; in spite of the war, which has so absorbed the thoughts of all nations, that the event which the Exposition celebrates—the opening of the Panama Canal—was relegated to the background of international affairs until its very existence seemed largely forgotten; in spite of these and other adverse factors of the situation, the Exposition has not only proved a successful event from a popular and spectacular point of view, but according to latest available reports the receipts have enabled provision to be made for all financial liabilities, so that from now on till the closing day, the Exposition has simply to pay its way. Judging from events still scheduled to take place, interest in the show ought to continue unabated.

Looking at the Exposition from an engineering point of view, one finds many features which mark a decided difference from previous and similar undertakings. The most peculiar feature and one which appeals with sudden force when its possible significance is fully realized, is the fact that for the first time on record, steam has been discarded as the source of power for the many exhibits in motion.

Internal combustion engines not only form the source of power, but, to the careful observer seem to surpass in interest, if not in magnitude, the magnificent displays so effectively staged by electrical corporations.

Wonderful may be the developments, and numerous the applications of electricity, but a point which should not be lost sight of is the fact that electricity is simply a form of energy, easy of transmission, application and control, but always dependent on some supply of mechanical energy for its creation.

Many parts of Canada are bountifully endowed by Nature with water power, which has been so developed for electrical purposes, that we give less thought to our electrical than to our water supply. On the other hand, people are apt to overlook the fact that while water in itself costs nothing, the utilization of the potential energy in water can only be accomplished in the highest degree by operations of great magnitude.

The remarkable degree of efficiency attained by internal combustion engines with low grade fuel is not confined to units of large size. Economy of operation comparable with modern hydro-electric plants is now obtainable with relatively small plants, and the possibilities of future oil developments in parts of the Dominion not too well favored with water power give to this type of engine an interest of more than passing moment.

While the absence of steam plant exhibits at San Francisco is perhaps due to a combination of geographical and commercial circumstances, the fact that there is a scarcity of such exhibits only intensifies the feature referred to.

The Canadian National Exposition which recently closed its doors after its 36th annual occurrence has not always featured engineering displays in a manner commensurate with the importance of either the event or the industry. At the present moment, and for a considerable time to come, the engineering firms of Canada will form one of the principal mainstays of the Dominion, if not the Empire. Future industrial developments demand that we be thoroughly familiar with every economic aspect of power generation and the various apparatus therefor. In the reconstruction of European industry our manufacturers will find ample opportunity for renewed activity, and the consistent education of power users should have careful consideration at the hands of our exhibition authorities.

Every encouragement should be given to manufacturers to exhibit both machinery and prime movers under actual conditions. The long delayed Machinery Hall should be provided at the earliest possible moment. The lack of suitable facilities for proper display has deterred many of our leading manufacturers from exhibiting in the past. A Technical Committee with power to negotiate suitable exhibits well ahead of time would eliminate many of the eleventh-hour efforts which are at present of yearly recurrence, and a combined display of machinery and manufacturing processes in an adequate manner would be attended with desirable results to exhibitors and authorities alike.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey forge, Pittsburgh	$14 70	
Lake Superior, charcoal, Chicago	15 75	
Ferro Nickel pig iron (Soo)	25 00	
	Montreal.	**Toronto.**
Middlesboro, No. 3	22 00	.....
Carron, special	23 00	.....
Carron, soft	23 00	.....
Cleveland, No. 3	22 00	.....
Clarence, No. 3	22 50	.....
Glengarnock	26 00	.....
Summerlee, No. 1	28 00	.....
Summerlee, No. 3	27 00	.....
Michigan charcoal iron	26 00	.....
Victoria, No. 1	23 00	20 50
Victoria, No. 2X	22 00	20 50
Victoria, No. 2 plain	22 00	2 50
Hamilton, No. -	22 00	20 50
Hamilton, No. 2	22 00	20 50

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	2.20
Steel bars, f.o.b., Toronto	2.20
Common bar iron, f.o.b., Montreal	2.20
Steel bars, f.o.b., Montreal	2.20
Twisted reinforcing bars	2.20
Bessemer rails, heavy, at mill	1.25
Steel bars, Pittsburgh	1.30
Tank plates, Pittsburgh	1.30
Beams and angles, Pittsburgh	1.30
Steel hoops, Pittsburgh	1.40
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.10
Small shapes	2.35
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.90
Structural shapes	1.95
Plates	1.95

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ¼ to ½ in., 100 lb.	$2 35	$2 25
Heads, per 100 lb.	2 55	2 45
Tank plates, 3-16 in.	2 60	2 45

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$12 25	$12 00
Copper, crucible	13 25	13 00
Copper, unch-bled, heavy	13 25	13 00
Copper, wire, unch-bled	14 00	14 00
No. 1 machine compos'n	11 50	11 50
No. 1 compos'n turnings	9 00	9 00
No. 1 wrought iron	8 50	6 50
Heavy melting steel	7 00	7 00
No. 1 machin'y cast iron	13 50	10 50
New brass clippings	11 00	11 00
No. 1 brass turnings	9 00	9 00
Heavy lead	4 00	5 00
Tea lead	$ 3 25	$ 3 50
Scrap zinc	10 50	9 00

W. I. PIPE DISCOUNTS.

Following are Toronto jobbers' discounts on pipe in effect Aug. 27, 1915:

	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
Standard				
¼, ⅜ in.	63	38½	....	....
½ in.	68	47½	....	....
¾ to 1½ in.	73	52½	....	....
2 in	73	52½	69	48½
2½ to 4 in	73	52½	72	51½
4½, 5, 6 in.	....	....	70	49½
7, 8, 10 in.	....	....	67	44½
X Strong P. E.				
¼, ⅜ in.	56	38½	....	....
½ in.	63	45½	....	....
¾ to 1½ in.	67	49½	....	....
2, 2½, 3 in.	68	50½	....	....
2 in.	....	....	63	45½
2½ to 4 in.	....	....	63	48½
4½, 5, 6 in.	....	....	66	48½
7, 8 in.	....	....	59	39½
XX Strong P. E.				
½ to 2 in.	44	26½	....	....
2½ to 6 in.	....	....	43	25½
7 to 8 in.	....	....	40	20½
Genuine Wrot Iron.				
⅜ in.	57	32½	....	....
½ in.	62	41½	....	....
¾ to 1½ in.	67	46½	....	....
2 in.	67	46½	63	42½
2½, 3 in.	67	46½	66	45½
3½, 4 in.	....	....	66	45½
4½, 5, 6 in.	....	....	63	42½
7, 8 in.	....	....	60	37½

Wrought Nipples.

4 in. and under	77½%
4½ in. and larger	72½%
4 in. and under, running thread	57½%

Standard Couplings.

4 in. and under	60%
4½ in. and larger	40%

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65%
Sq. Head Set Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45%
Flat & But. Head Cap Screws	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in. N.	70%
Semi-Fin. Nuts up to 1 in.	70%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

METALS.

	Montreal.	Toronto.
Lake copper, carload	$20 00	$19 00
Electrolytic copper	20 00	18 75
Castings, copper	19 75	18 50
Tin	39 00	39 00
Spelter	18 00	18 00
Lead	6 15	6 25
Antimony	35 00	35 00
Aluminum	50 00	55 00

Prices per 100 lbs.

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh	$24 50
Openhearth bilets, Pittsburgh	25 00
Forging billets, Pittsburgh	32 00
Wire rods, Pittsburgh	30 00

NAILS AND SPIKES.

Standard steel wire nails, base	$2 40	$2 35
Cut nails	2 50	2 70
Miscellaneous wire nails	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	75
Stove bolts	80
Plate washers	40
Machine bolts, ⅜ and less	70
Machine bolts, 7-16 and over	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes	4¼c per lb. off
Nuts, Hexagon, all sizes	4¾c per lb. off
Iron rivets	72½ per cent.
Boiler rivets, base, ¾-in. and larger	$3.75
Structural rivets, as above	3.75
Wood screws, flathead, bright	85, 10, 7½, 10 p.c. off
Wood screws, flathead, Brass	75 p.c. off
Wood screws, flathead, Bronze	70 p.c. off

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Standard. Price. per ft.	Extra Strong, Sizes Ins.	Extra Strong, Price per ft.	D. Ex. Strong, Size Ins.	D. Ex. Strong, Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.....
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....

COKE AND COAL.

Solvay Foundry Coke	$5.75
Connellsville Foundry Coke	5.00
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

COLD DRAWN STEEL SHAFTING.

At mill	45%
At warehouse	40%

Discounts off new list. Warehouse price at Montreal and Toronto.

MISCELLANEOUS.

Solder, half-and-half	0.23
Putty, 100-lb. drums	2.70
Red dry lead, 100-lb. kegs, per cwt.	9.65
Glue, French medal, per lb.	0.18
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.18
Benzine, single bbls., per gal.	0.18
Pure turpentine, single bbls.	0.64
Linseed oil, raw, single bbls.	0.65
Linseed oil, boiled, single bbls.	0.68
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Lead wool, per lb.	0.10
Pure Manila rope	0.16
Transmission rope, Manila	0.20
Drilling cables, Manila	0.17
Lard oil, per gal.	0.73
Union thread cutting oil	0.60
Imperial quenching oil	0.35

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto 40%

PROOF COIL CHAIN.

1/4 inch	$8.00
5-16 inch	5.35
3/8 inch	4.60
7-16 inch	4.30
1/2 inch	4.05
9-16 inch	4.05
5/8 inch	3.90
3/4 inch	3.85
7/8 inch	3.65
1 inch	3.45

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	60
Carbon over 1½ in.	25
High Speed	40
Blacksmith	60
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Centre	25
Pipe Reamers	80

Discounts off standard list.

IRON PIPE FITTINGS.

Canadian malleable, A, 25 per cent.; B and C, 35 per cent.; cast iron, 60; standard bushings, 60 per cent.; headers, 60; flanged unions, 60; malleable bushings, 60; nipples, 75; malleable, lipped unions, 65.

TAPES.

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic. 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3.50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$2 70	$2 70
Canada plates, dull, 52 sheets	3 15	3 15
Canada Plates, all bright	4 75	4 75
Apollo brand, 10¾ oz. galvanized	6 40	5 95
Queen's Head, 28 B.W.G.	6 00	6 25
Fleur-de-Lis, 28 B. W. G.	5 75	5 75
Gorbal's Best, No. 28	6 00	6 00
Viking metal, No. 28	6 00	6 00
Colborne Crown, No. 28	5 38	5 30
Premier No. 28	5 60	5 50

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$11 00	.....
1¼ in.	11 00	.....
1½ in.	11 00	.....
1¾ in.	11 00	.....
2 in.	11 50	8 75
2¼ in.	13 00	10 50
2½ in.	14 00	11 15
3 in.	16 00	12 10
3½ in.	20 00	14 15
4 in.	25 50	18 00

Prices per 100 feet, Montreal and Toronto.

WASTE.

WHITE.	Cents per lb.
XXX Extra	0 11
X Grand	0 10½
XLCR	0 09¾
X Empire	0 09
X Press	0 08¼
COLORED.	
Lion	0 07½
Standard	0 06¾
Popular	0 06
Keen	0 05½
WOOL PACKING.	
Arrow	0 16
Axle	0 11
Anvil	0 08
Anchor	0 07
WASHED WIPERS.	
Select White	0 08½
Mixed Colored	0 06¼
Dark Colored	0 05¼

This list subject to trade discount for quantity.

BELTING RUBBER.

Standard	50%
Best grades	30%

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50%
Standard	50 & 10%
Cut leather lacing, No. 1	$1.20
Leather in sides	1.10

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	$9.00
1/4 in.	6.25
5-16 in.	4.65
3/8 in.	4.00
7-16 in.	4.00
1/2 in.	4.00

Prices per 100 lbs.

PLATING CHEMICALS.

Acid, boracic	$ .15
Acid, hydrochloric	.05
Acid, hydrofluoric	.06
Acid, Nitric	.10
Acid, sulphuric	.05
Ammonia, aqua	.08
Ammonium carbonate	.15
Ammonium chloride	.11
Ammonium hydrosulphuret	.35
Ammonium sulphate	.07
Arsenic, white	.10
Copper sulphate	.10
Cobalt Sulphate	.50
Iron perchloride	.20
Lead acetate	.16
Nickel ammonium sulphate	.10
Nickel carbonate	.50
Nickel sulphate	.17
Potassium carbonate	.40
Potassium sulphide	.30
Silver chloride (per oz.)	.65
Silver nitrate (per oz.)	.45
Sodium bisulphite	.10
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.35
Sodium hydrate	.04
Sodium hyposulphite (per 100 lbs.)	3.00
Sodium phosphate	.14
Tin chloride	.45
Zinc chloride	.20
Zinc sulphate	.08

Prices Per Lb. Unless Otherwise Stated.

ANODES.

Nickel	.47 to .52
Cobalt	1.75 to 2.00
Copper	.22 to .25
Tin	.45 to .50
Silver	.55 to .60
Zinc	.22 to .25

Prices Per Lb.

PLATING SUPPLIES.

Polishing wheels, felt	1.50 to 1.75
Polishing wheels, bullneck	.80
Emery in kegs	.4½ to .06
Pumice, ground	.05
Emery glue	.15 to .20
Tripoli composition	.04 to .06
Crocus composition	.04 to .06
Emery composition	.05 to .07
Rouge, silver	.25 to .50
Rouge, nickel and brass	.15 to .25

Prices Per Lb.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., Sept. 27, 1915.—The recent favorable news from the front has had a cheering effect in business circles and will assist materially in stimulating business. The manufacture of shells is proceeding in a satisfactory manner, and it is generally believed that further contracts will be placed at no distant date. The manufacture of field guns is being contemplated, but nothing has been done beyond making preliminary investigations. A committee has been apointed to look into the matter.

Steel

Steel, as usual, is still holding the central position in the market, as the demand, both for bars and billets is still heavy. The demand for shells seems as urgent as ever and with the prospect of larger shells being manufactured the steel makers will be kept busy for some time to come. With the possible advent of gun making having the attention of the Canadian manufacturer, the steel industry will necessarily have to face a new problem in producing the required raw material.

Pig Iron

Quotations on pig iron remain firm, there being very little change in the situation. There has only been a moderate turnover during the week, the strength of the market being due to the sales already made.

Machine Tools and Supplies

The machinery outlook for the week is little changed. Deliveries are still very backward for certain tools, especially those required for the production of high-explosive shells.

That new possibilities for the machine tool builder are becoming evident, is the fact that steps are now being taken to see what can be done in the making of field guns for the Allied Governments. The manufacture of these guns would create a demand for new and heavier types of machine tools and would tax the resources of the tool manufacturers. There would also be a bigger demand for small tools and attachments.

Metals

Quotations on the different metals show little change over those of the previous week. Prices are holding firm with the exception of antimony, which shows a slight decline.

Old Materials

Several fluctuations have been noticed in the scrap prices during the week. The present price of wrought iron scrap is $2 per 100 lbs. higher than a week ago; machinery scrap iron shows an advance of $3 and scrap zinc $2, while a decline of 20 per cent. is shown in heavy lead.

Toronto, Ont., Sept. 28.—The remarkable development in the export trade of Canada is shown in the returns recently issued by the Department of Trade and Commerce. In August alone the export of manufactured goods reached a total of over two million dollars, practically double that of the corresponding month last year. This heavy increase is largely attributable to the heavy output of war munitions. The returns of the export trade for the five months of the present fiscal year show a total of over two hundred million dollars, representing an increase of fifty million dollars. The value of imported goods shows a falling off of about four million dollars.

CANADIAN GOVERNMENT PURCHASING COMMISSION

The following gentlemen constitute the Commission appointed to make all purchases under the Dominion $100,000,000 war appropriation:—George F. Galt, Winnipeg; Hormidas Laporte, Montreal; A. E. Kemp, Toronto. Thomas Hilliard is secretary, and the commission headquarters are at Ottawa.

While the above condition is distinctly beneficial to the Dominion, the full effect has not yet begun to be felt. The domestic trade is still comparatively quiet, although a more optimistic spirit prevails in business circles. There is, generally speaking, a feeling of returning confidence, due to the large crops and encouraging trade returns.

The steel trade continues very active, due to the heavy demand for steel for munitions. The outlook in the trade was never better. The demand for machine tools has fallen off, on account of there being no new orders for shells placed recently. It is, however, confidently expected that there will be a revival of business at no distant date. There is little of interest to note this week in the metal markets. The trade is awaiting developments in the sterling exchange situation. The scarcity of aluminum is becoming more pronounced and prices have made a sharp advance. Apart from this the markets are steady.

Steel Market

The market is very firm, and the mills continue to do big business. The demand for steel for munitions is so great that Canadian firms have been obliged to import billets and steel rounds from the States, notwithstanding the fact that some of these concerns have recently increased their producing capacity. Prices are holding very firm, and an advance in bars may be announced at any time. The demand for steel, other than for shells, and export trade, is light.

The high-speed tool steel situation continues to cause considerable anxiety to consumers owing to scarcity and advancing prices. Stocks are getting lower, and the demand is becoming heavier. The Vanadium Alloys Steel Co., of Pittsburgh, announce a further advance of 15c per pound, while other markers have also been obliged to raise their prices. Makers in Sheffield, England, are having the greatest difficulty in supplying their Canadian customers on account of the heavy demand in the home market. Prices of galvanized sheets are easier owing to the downward tendency in the spelter market. Sales are not very heavy, largely due to the mills refusing to sell for extended delivery. Prices of black sheets are firm, and there is a tendency towards higher prices.

Heavy export business is becoming a more dominant factor in the steel trade in the States than at any time since the beginning of the war. Large orders for bars for shells are being placed and deliveries are running into next year, being practically unobtainable this year. Prices are very firm, and the market generally has an upward tendency. There is a big demand for billets, and prices are naturally advancing. Bessemer and open-hearth billets have advanced again, and are being quoted at $24.50 and $25 respectively.

Pig Iron

There is practically no improvement in the foundry pig iron situation, and foundries are moving cautiously in buying for future requirements. Prices have advanced and Hamilton and Victoria brands are being quoted at $20.50 per ton.

Machine Tools

The demand for new tools has fallen off considerably, due to the lack of new shell orders, and also the difficulty of obtaining new machinery. Makers are in a sold-up condition, and deliveries are as backward as ever. This situation has resulted in a demand for second-hand equipment, although even in this case business has fallen off to some extent. Inquiries now are principally for tools for making shell parts, and quite a number of second-hand tools have been sold recently for making that part of a shell called a "Gaines."

Supplies

Business continues good and prices firm. Prices of high-speed steel cutters of all descriptions have been withdrawn on account of the difficulty in obtaining raw material. Boiler and structural rivets, 3/4 in. and larger, have been advanced from $3.25 to $3.75. Solder, half-and-half, has declined 1c, and is now quoted at 23c per pound.

Metals

The markets are firm and prices steady, with the exception of aluminum, which has made a sharp advance. The entire market is awaiting the outcome of the loan negotiations now being carried on between representatives of the British and French Governments and American financial interests in New York. The market is being affected by the sterling exchange situation, and it is generally believed that the situation will improve considerably if the price of the pound sterling rises to a more normal basis. Business conditions locally are unchanged, the principal demand being for metals for munitions.

Tin.—The market is firm, with an upward tendency in London. There is, however, comparatively little interest being shown in either spot or future deliveries. The market is being adversely affected by the sterling exchange situation. Local quotations are unchanged at 39c per pound.

Copper.—The market is still awaiting the big buying movement, which showed some evidence of starting about three weeks ago. Production of copper at the present rate is believed to be in excess of consumption, and hence it is believed that buyers of the metal are better able to hold off and purchase only for immediate needs than they were a few months back, owing to the heavy demand for copper for munitions. There is every probability of an increase in consumption when the sterling exchange situation improves. Quotations for copper locally are unchanged at 19c per pound.

Spelter.—The market is stronger with the possibility of higher prices. Consumers are taking more interest in spot and near-by positions, but the demand is not heavy. Quotations are unchanged at 18c per pound.

Lead.—The market is firm and unchanged. The "Trust" price of $4.50 New York is being maintained, and it is generally believed that this will hold steady for some time. Local quotations are unchanged at 6¼c per pound.

Antimony.—The market is dull and featureless. Quotations are unchanged at 35c per pound.

Aluminum.—Supplies of this metal are becoming more difficult to obtain, and with an increasing demand the situation may be said to be acute. Quotations have advanced 15c, and are entirely nominal at 55c per pound.

St. John, N.B., Sept. 25.—Local industrial conditions continue to be satisfactory, the only effects of the war so far as can be noticed, being the absence of new building enterprises, though as regards the volume of trade with most houses it goes along in a steady and encouraging manner. Collections throughout the province are fair. The lumbering season has been better than was generally anticipated last spring. Fishing, particularly along the North Shore, has been exceptionally good, and except in some quarters, the crops have been well up to the standard. Thus it follows that manufacturers are finding at least a good home market, and few complaints are heard as to the falling off of business. It is not so good, of course, as if there had been no war, but all things considered there is no reason to grumble. The orders for war supplies have also been an important factor in Maritime Province towns and cities, and have helped to keep many men employed. There promises to be considerable shipping from Halifax and St. John this winter, and at the latter port the C. P. R. are now seeking extra accommodation.

A new flour mill is to be built at Newcastle, N.B., to cost in the vicinity of $6,500. Its capacity will be one barrel an hour. The matter has been decided upon favorably by the Board of Trade, and a committee composed of Hon. John Morrissy, Secretary E. A. McCurdy and John Betts have been appointed to look into the matter and report back. About fifteen million feet of lumber on the dock yard of the Bathurst Lumber Co. at Bathurst, N.B., were destroyed in a fire there this week. The lumber was valued at $250,000, which was well covered by insurance.

The expectation is that early in October the street cars will be crossing the new spandril arch bridge across the Reversing Falls, St. John, N.B., just recently completed. A diamond crossing has been ordered and the plans are about completed. The old Suspension Bridge has been dismantled and removed by men under Contractor McVey. The granite blocks are being taken to Moncton for use in the new bridge there. The death of a well-known business man of St. John occurred this week in the person of Frank H. Foster, aged 62 years. He was secretary-treasurer of the Canada Brush Co., of St. John and had been one of its promoters. Mr. Foster was also head of the wholesale firm of Foster & Co. He was particularly well known throughout Eastern Canada and very highly respected.

ALLIES PURCHASING AGENTS

The Trade and Commerce Department, Ottawa, has published the following list of purchasing agents for military purposes for the allied Governments:

International Purchasing Commission, India House, Kingsway, London, Eng.

French.—Hudson Bay Co., 56 McGill Street, Montreal; Captain Lafoulloux, Hotel Brevort, New York; Direction de l'Intendence Ministere de la Guerre, Bordeaux, France; M. De la Chaume, 28 Broadway, Westminster, London.

Russian.—Messrs. S. Ruperti and Alexsieff, care Military Atache, Russian Embassy, Washington, D.C.

A POSSIBLE STEEL FAMINE

THE First National Bank of Boston, Mass., in a recent letter, says:—

"Although a brand new furnace may be blown in here and there, it takes a year or two to make a general increase in steel-making capacity. This question is being discussed because authorities in the trade announce that the steel industry is running almost at capacity—that it is from 60 to 90 days behind in deliveries, especially on bars, and that it is sold out through 1915 with contracts offering for 1916. It is even hinted that a famine in steel will develop in 1916 if the present trend continues. Moreover, it is pointed out that the railroads have not been in the market for equipment since 1906; and that they will be driven in by the existing activity and this time for heavier equipment than has ever been known. For example, the Pennsylvania is ordering a 140,000-pound 'Dreadnought' freight car—the heaviest ever constructed, which will necessitate either all steel wheels or a 6-wheel truck, and may ultimately lead to a heavier rail, heavier trestle, and freer use of heavier steel throughout. Buying of this character by the railroads might prolong the revival in steel over years.

"Analysis of the steel trade shows a somewhat peculiar condition. At the bottom of the boom is, of course, the war orders. It is probable that export business in steel takes up from 40 to 60 per cent. of present production. Domestic business lags; car building is comparatively light as yet; new construction of buildings requiring structural steel is sub-normal; and only a few more rails have been bought in 1915 than in 1914. The automobile industry is about the only domestic consuming steel line which

is fully active. Despite the lack of domestic steel consumption, the trade is reported full and sold out. On the basis of contracts received, the steel trade is probably sold out as stated, but October is awaited as the test month of the genuineness of the boom as regards specifications and production—March and October being the best steel months of the year."

CANADA'S TRADE STATEMENT

A FAVORABLE showing is made in Canada's trade statement for August and for the five months of the fiscal year ended with that month. The total trade in merchandise in August was $81,926,976 against $75,901,335 in the corresponding month, an increase of six million. In the five months of the fiscal year the aggregate was $375,824,612, as against $364,197,801, an increase of eleven millions. Imports in August were $40,832,822, a falling off of four millions and exports $41,094,154, an increase of ten millions. Total imports in the five months were $175,562,199, a decrease of forty millions, while the exports were $200,262,413, an increase of fifty millions.

Various Exports

The export of manufactured goods in August was $10,690,464, practically double that of last year, while for the five months they were $62,231,845, as against $26,728,965. The marked increase is largely attributable to the heavy output of war munitions.

Agricultural exports in August totalled $6,895,726, a falling off of half a million, while for the five months domestic agricultural exports were $48,207,048, a decrease of two millions.

Mineral exports totalling $6,090,370 increased in August by a million and a half and in the five months by three millions. Animals and animal products likewise show an increase. In August the total was $9,193,103. Forest products exported in August were $5,846,890, an increase of a million and a half. In the five months the total was slightly over twenty-two millions, an increase of three millions.

Duty Collected

The total duty collected in August was $8,431,565, an increase of $70,000 over August of last year, while for the five months it aggregated $36,514,037, a decrease of $300,000.

It is apparent that the extra duties, designed to keep the revenue abreast of the ante-bellum period are accomplishing that purpose.

The Dominion Stamping Co,. Walkerville, Ont., will in future be known as the Dominion Forge and Stamping Co.

CANADIAN COMMERCIAL INTELLIGENCE SERVICE

The Department of Trade and Commerce invites correspondence from Canadian exporters or importers upon all trade matters. Canadian Trade Comissioners and Commercial Agents should be kept supplied with catalogues, price lists, discount rates, etc., and the names and addresses of trade representatives by Canadian exporters. Catalogues should state whether prices are at factory point, f.o.b. at port of shipment, or, which is preferable, c.i.f. at foreign port.

CANADIAN TRADE COMMISSIONERS.

Argentine Republic.
H. R. Poussette, 278 Balcarce, Buenos Aires. Cable Address, Canadian.

Australasia.
D. H. Ross, Stock Exchange Building, Melbourne, Cable address, Canadian.

British West Indies.
E. H. S. Flood, Bridgetown, Barbadoes, agent also for the Bermudas and British Guiana. Cable address, Canadian.

China.
J. W. Ross, 6 Kiukiang Road, Shanghai. Cable Address Cancoma.

Cuba.
Acting Trade Commissioner, Lonja del Comercio, Apartado 1290, Havana. Cable address, Cantracom.

France.
Phillipe Roy, Commissioner General, 17 and 19 Boulevard des Capucines, Paris. Cable address, Stadacona

Japan.
G. B. Johnson, P.O. Box 109, Yokohama. Cable Address, Canadian.

Holland.
J. T. Lithgow, Zuidblaak, 26, Rotterdam. Cable address, Watermill.

Newfoundland.
W. B. Nicholson, Bank of Montreal Building, Water Street, St. John's. Cable address, Canadian.

New Zealand.
W. A. Beddoe, Union Buildings, Customs Street, Auckland. Cable address, Canadian.

South Africa.
W. J. Egan, Norwich Union Buildings, Cape Town. Cable address, Cantracom.

United Kingdom.
E. de B. Arnaud, Sun Building, Clare Street, Bristol. Cable address, Canadian.
J. E. Ray, Central House, Birmingham. Cable address, Canadian.
Acting Trade Commissioner, North British Building East Parade, Leeds. Cable address, Canadian.
F. A. C. Bickerdike, Canada Chambers, 36 Spring Gardens, Manchester. Cable address, Cantracom.
Fred. Dane, 87 Union Street, Glasgow, Scotland. Cable address, Cantracom.
Harrison Watson, 73 Basinghall Street, London, E.C., England. Cable address, Sleighing, London.

CANADIAN COMMERCIAL AGENTS.

British West Indies.
Edgar Tripp, Port of Spain, Trinidad. Cable address, Canadian.
R. H. Curry, Nassau, Bahamas.

Colombia.
A. E. Beckwith, c-o Tracey Hmos, Medellin, Colombia. Cables to Marmato, Colombia. Cable address, Canadian.

Norway and Denmark.
C. E. Sontum, Grubbeged No. 4, Christiana, Norway. Cable address, Sontums.

South Africa.
D. M. McKibbin, Parker, Wood & Co., Buildings, P.O. Box 559, Johannesburg.
E. J. Wilkinson, Durban, 41 St. Andrew's Buildings, Durban, Natal.

CANADIAN HIGH COMMISSIONER'S OFFICE.

United Kingdom.
W. L. Griffith, Secretary, 17 Victoria Street, London, S.W., England.

Producing Fuse Sockets and Plugs for Shrapnel Shells

Staff Article

The problem of how to produce to specification a satisfactory article of high-degree accuracy, and yet at a price low enough to be consistent with the temporary nature of the service required, is well instanced in the manufacture of sockets and plugs.

THE observations and impressions derived from an hour or two spent in a small factory manufacturing the component parts of the finished shrapnel shell give to the thoughtful mind a clearer conception of the energy and resourcefulness of the average Canadian manufacturer when the time comes for him to develop to the utmost the equipment at his command.

The speed with which this productive power has been brought to the highest point of efficiency shows the determined interest and sterling qualities of both the manufacturer and the various artisans required to produce the necessary results.

One of the features of this great movement which is worthy of commendation is the co-operation of effort among many manufacturers to reduce to the minimum the delay often necessary when equipment is required for the completion of one or more parts of a much needed article. Often a manufacturer may be able to accomplish the required result with the exception of one operation. To do this operation it may be necessary to install expensive machinery; but if this operation can be performed in another establishment within a reasonable distance, the co-operation of these firms along the desired lines may mean much to the final outcome, as well as mutual benefit to themselves.

In the manufacture of shells, both shrapnel and high explosive, many component parts are required which necessitate their production in separate plants to those equipped for the making of the shell body. In producing the fuse sockets and brass plugs which form the nose of the finished shell, one of the necessary requirements is the brass foundry.

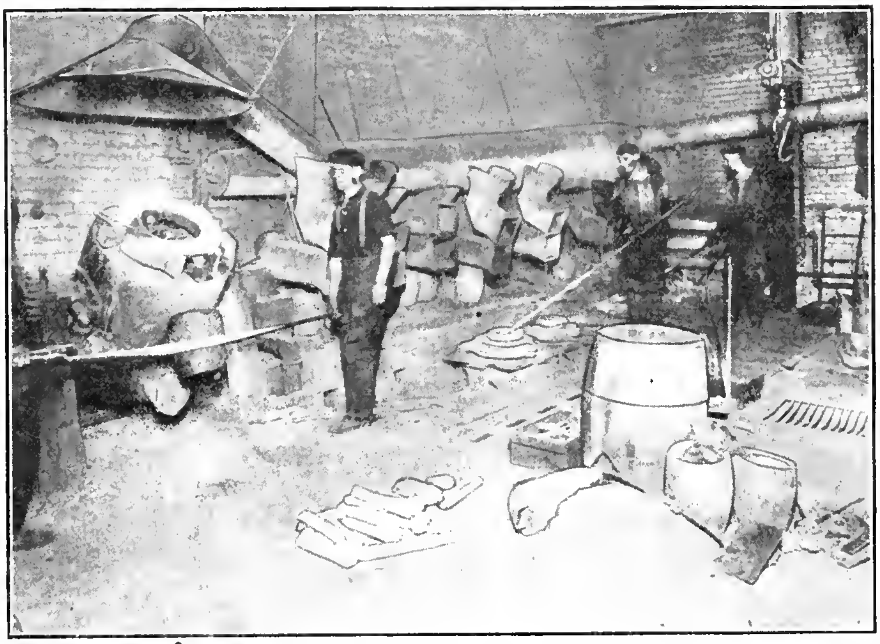


FIG. 1. CRUCIBLE SECTION OF BRASS FOUNDRY WHERE SLUGS FOR FUSE SOCKETS ARE PRODUCED.

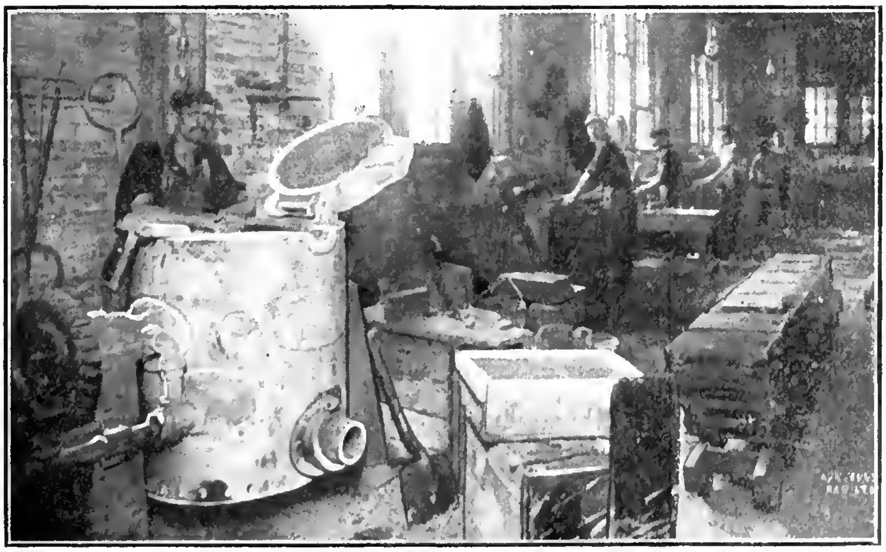


FIG. 2. FUSE SOCKET PRODUCTION IN THE FOUNDRY.

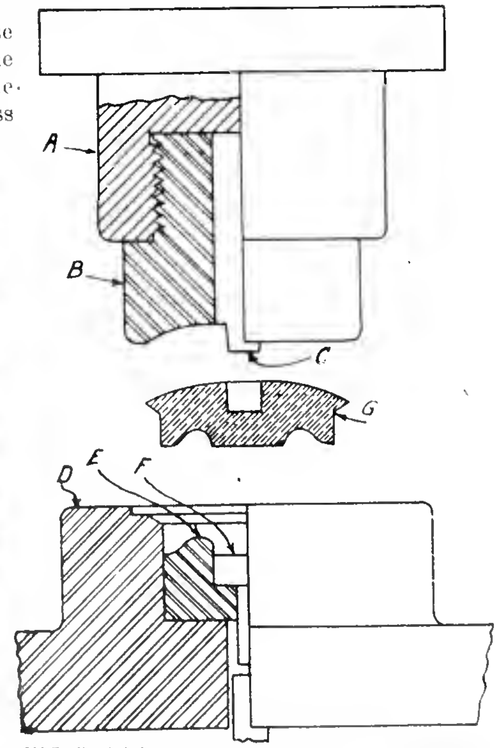


FIG. 5. DIE FOR FORGING BRASS PLUGS.

The subject matter of this article was obtained from observation and impressions derived from a visit to a plant, which for years has been employed in the production of gas and electrical fixtures, as well as filling orders for a large variety of brass and aluminum articles.

Casting the Slugs.

Fig. 1 shows a view of the foundry where the slugs are cast before the forging operation. In this picture is shown

the crucible section where the various metals are melted before pouring into the moulds. At the extreme right and also at the left are two crucibles which have a capacity of 500 lbs. apiece; another of these is shown in Fig. 2, which is being repaired. Beside these three, there are ten others beneath the floor, each having a capacity of 150 lbs. These furnaces (of natural gas) are in operation at present 24 hours a day, metal being poured off at intervals of 15 or 20 minutes, day and night. The composition of this metal for the fuse sockets

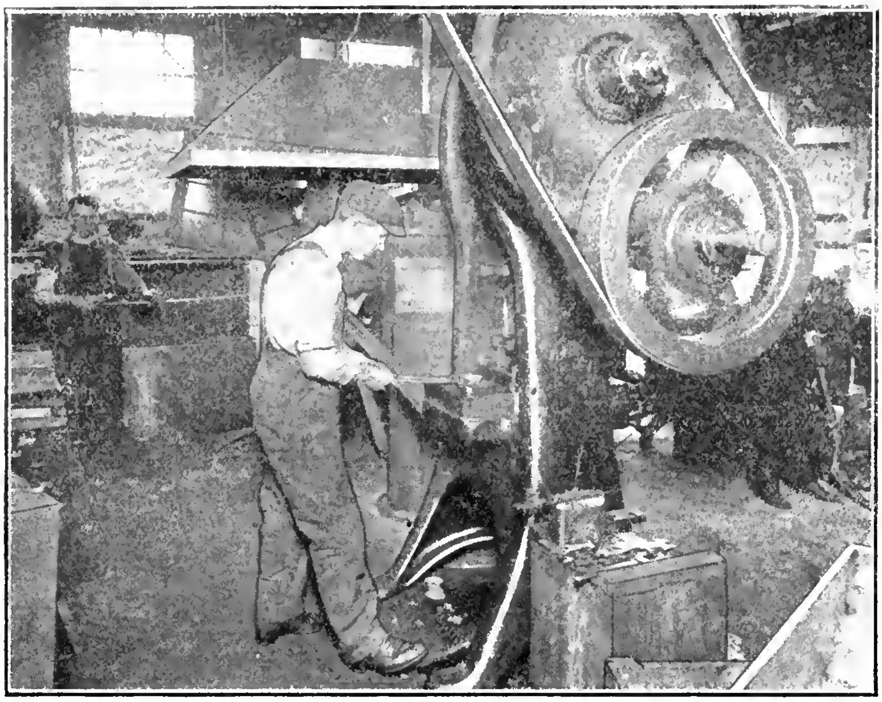


FIG. 3. POWER PRESS FORGING SLUGS INTO FUSE SOCKETS AND PLUGS.

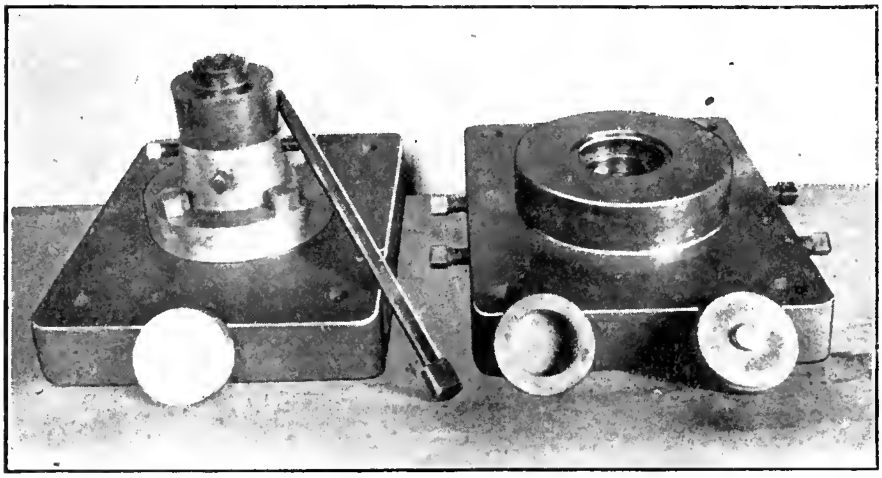


FIG. 4A. DIE FOR FORGING BRASS SOCKETS.

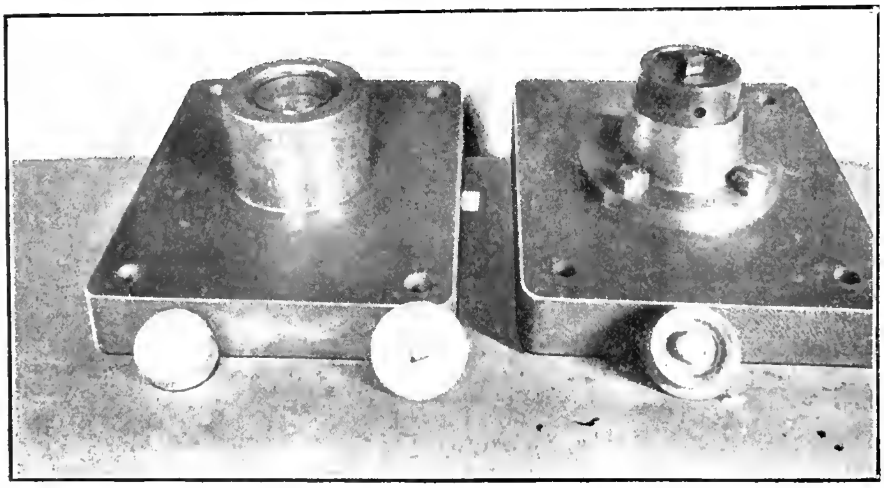
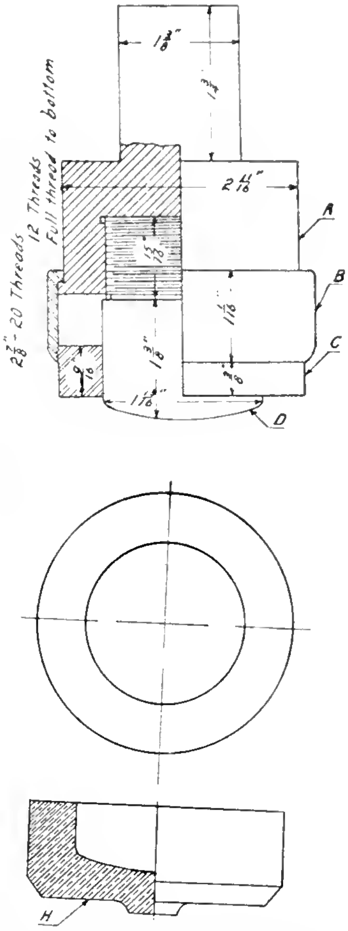


FIG. 5A. DIE FOR FORGING SOCKET PLUGS.



SECTION OF SOCKET AND DIE.

is 40 per cent. copper, 58 per cent. zinc, and 2 per cent. lead.

Fig. 2 shows a view of the floor and benches where the metal is poured into the various moulds previously prepared.

Forging Fuse Sockets and Plugs.

After the slugs are sufficiently cold to be removed, they are shaken out and gathered up and taken to another factory some distance away, who have a

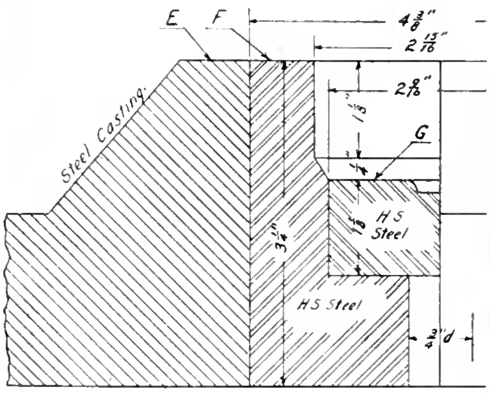


FIG. 4. DIE FOR FORGING BRASS SOCKETS.

press suitable for forging these slugs into the desired shape.

This operation is shown in Fig. 3. In the background is the furnace where the slugs are heated to a cherry red and passed to the man at the press by means of the trough shown. This operator places the hot slug into the die and the punch upon descending forms the piece into the desired shape. The construction of these dies is shown in Figs. 4 and 5, Fig. 4 being the die for the sockets and Fig. 5 the die for the plugs. A view of the finished forging is also shown with each die; also shown in Fig. 4a and 5a.

Machining Sockets.

The first machining operation is performed on a Warney & Swasey turret machine. The cycle of operations is chucking, drill bore and face, undercutting, tapping, finish face and ream. At periods during these operations a blast of air is forced into the recess to remove surplus cuttings; this is shown in Fig. 6.

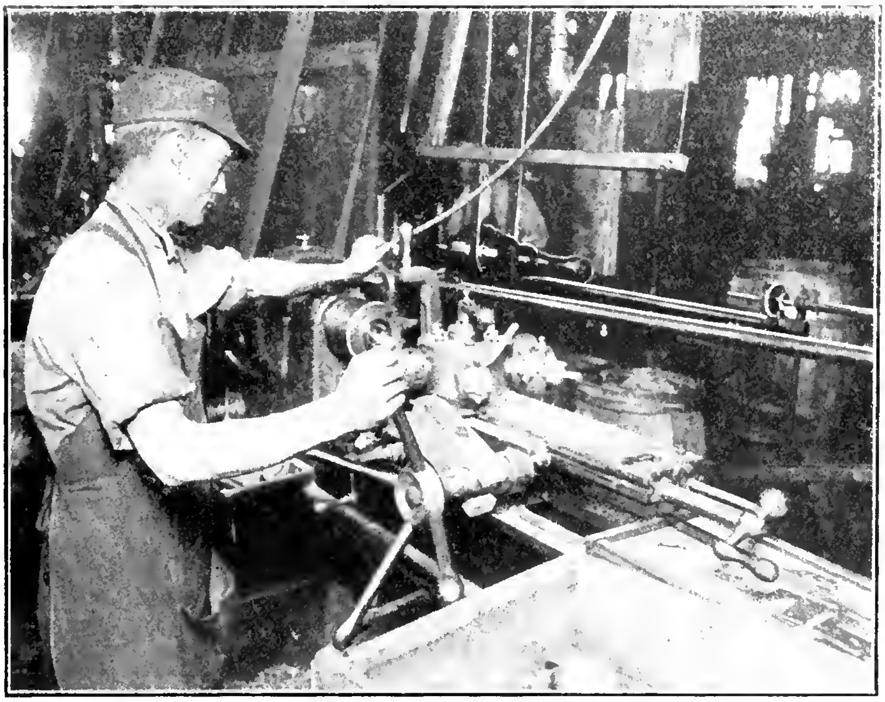


FIG. 6. FIRST MACHINING OPERATION ON FUSE SOCKETS.

The second operation on the fuse sockets (also done on a Warney & Swasey turret machine) is the finishing of the side which screws into the nose of the shell. This operation is shown in Fig. 7. The cycle of operations is chucking, roughing from the back, finishing from the front, and threading with the die. The sockets are then drilled and tapped for a small screw used for locking time fuse in position; they are then retapped to the finished size.

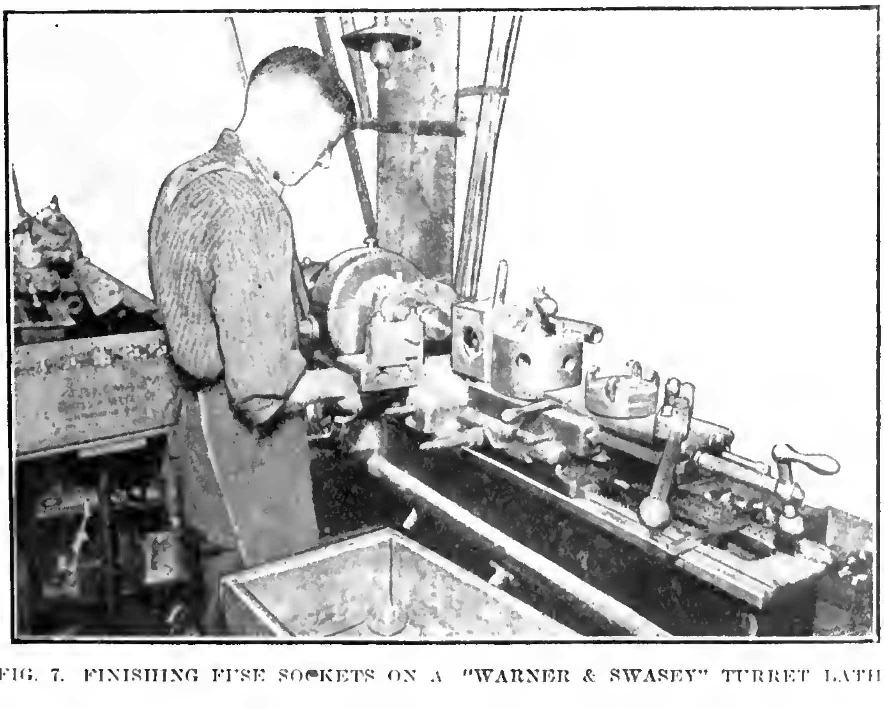


FIG. 7. FINISHING FUSE SOCKETS ON A "WARNER & SWASEY" TURRET LATHE

Machining the Plugs.

The work on the plug is done at one setting, the cycle of operations being chucking, roughing, undercutting and threading. This operation is shown in Fig. 8. These plugs are used to protect the fuse socket during the period of transportation, after which they are replaced by the timing fuse.

HOW METAL COOLS FROM LIQUID TO SOLID

IN the course of a lecture delivered before the Sheffield branch of the British Foundrymen's Association on April 30, Dr. W. Rosenhain, F.R.S. (Head of the Metallurgical Department of the National Physical Laboratory), advanced an interesting theory, the consideration of which might enable one to understand some of the things which happen during the cooling of metals.

Special attention was given to the consideration of the existence of non crystalline or amorphous layers in metal bodies which have been cooled from a liquid condition. The "change of state" which took place during solidification involved something more than the formation of mere crystals commonly understood. Crystals invariably form at right angles to surfaces which happen to be at uniform temperatures, the growth of these crystals beginning at different points of centres termed nuclei where the temperature of the metal first reaches the freezing point. Each of these nuclei or centres then extended in all directions, meeting the arms of other nuclei and causing the crystal growth to permeate the whole body as quickly as the various parts reached the state of solidification, on freezing point.

By a crystalline body was meant one in which the particles, of which the body was composed were arranged in some regular manner. The absence of such a crystalline formation was termed an amorphous state, and science had enabled a very considerable insight to be obtained regarding the manner in which these particles were formed, as well as their absence. The growth of a crystalline structure did not result from the building up of successive layers, but by shooting out branches until these met other branches and the intervening spaces were filled up. What was it that made the atoms of the metal arrange themselves in this way? Clearly there was some directing force which made the atoms turn and arrange themselves.

and determined whether a given atom should adhere to one crystal or to another. It would appear that the attractive force acting on the atom from one crystal was greater than those acting upon it from another.

The Amorphous Theory

But ultimately a point must be reached between two growing crystals where the opposing forces of the crystal growths were nearly balanced and the atom was not impelled very strongly one way or the other, and therefore did not range itself definitely on either side. The effect of the two such opposing forces was very clearly illustrated in the attraction of iron filings by the two similar poles of a magnet (as shown by means of a slide) between which there was a distinct neutral ground where the two opposing sets of forces were so nearly balanced that the particles of iron arranged themselves in a completely indifferent manner. So in the case of a cooling mass of metal, there would be a neutral zone between any two crystals where the atoms would go on cooling down without arranging themselves in crystalline order. This amorphous or non-crystalline layer between the crystals of metal would have the hardness characteristic of all under-cooled materials. The behaviour of pure iron which would consist of crystals of iron, with amorphous layers between, was considered. The amorphous layers would be stronger and harder than the crystals themselves, and if strained or deformed there should be very little movement at the boundaries of the crystals, all the movement taking place within the crystals themselves. Slides were exhibited which showed that deformation of the body as a whole was accomplished by deformation of the crystals themselves.

A temperature of 900 deg. Cent., however, approached somewhat to the softening point of the amorphous layers, while the crystals melted suddenly and changed from the solid to the completely liquid at a much higher temperature. At such a temperature as 900 Cent., nearly all movement took place by the sliding over one another of the boundaries. Thus the flow of these metals at high temperatures obeyed the law of the flow of various liquids. To carry the process a little further, the deformation might be continued until rupture took place; in the cold metal the crystals broke across but at a suitable high temperature the crystals could be pulled apart from one another quite easily, so that the fracture followed the crystal boundaries. Several slides were shown illustrating the varying course of the fractures at different temperatures, with various metals, including purest gold, to show that the action was not attributable to the presence of impurities, as was sometimes suggested by opponents of the theory which was also confirmed by experiments in vacuum.

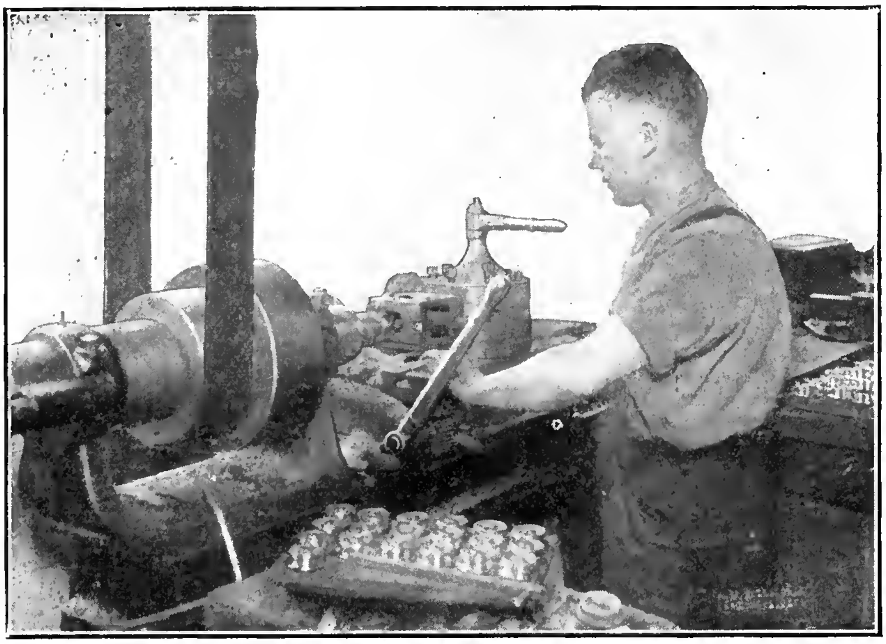


FIG. 8. FINISHING BRASS PLUGS ON FLAT TURRET LATHE.

Experiments in latent heat also, in the opinion of the lecturer, clearly indicated differences which would be very hard to explain on any other physical ground. He was quite prepared to admit that there was no definite proof of the existence of this "amorphous cement," but some people would never be convinced until one could hit them with a piece of amorphous metal. At the same time he thought there was enough evidence to indicate that there must be something in the theory. It explained the difference in the mechanical properties of metals, which depended upon the size of their crystal structure; and the curious difference in their elastic limit was very readily explained by it. It also served to give a reasonable explanation to that most puzzling of all facts, that a very small proportion of impurities produced such enormously disproportionately large mechanical, electrical and other effects; these added bodies would always tend to concentrate themselves in this amorphous cement, and might account for the large effect of vanadium on steel. This, he thought, was one of the most fruitful applications which the theory offered, but a good deal remained to be done in working out these applications; it showed why other things injured steel, because they spoiled the binding power of this amorphous cement. Dr. Rosenhain also discussed the separation of the various constituents of alloys, the formation of solid solutions, and the formation of cores. Cores were due to the rate of cooling; only by a slow cooling could completely homogeneous crystalline aggregate be obtained. The limitation of phosphorus in steel was considered, fissures in shrapnel shells being due in his opinion to regions of low carbon and high phosphorus, resulting in layers of different hardness. The remedy was to eliminate the phosphorus as far as possible, or to render its distribution uniform. One way was to decrease the speed of solidification of the steel, and if that was impracticable, the next best thing was to anneal the steel very drastically at a certain stage in the working.

ZINC DISCOVERED IN NORTHERN QUEBEC

ZINC in large quantities is reported to have been discovered in the vicinity of Burbridge Lake, in the Upper Gatineau district, Quebec, north of Ottawa. Denis Callahan, a Haileybury prospector, recently found evidences of this mineral in that part of the Laurentian hills, and engineers will investigate.

John D. Macfarlane, a mining engineer of Shawville, who was in the capital on his way up to look over the locality, believes it possible that zinc will be found there in considerable quantities. He is familiar with the country, and reports already made indicate that the deposits may prove as valuable as those now controlled by the New Jersey Zinc Corporation in that state. Conditions in the Burbridge Lake district are reported to be similar to those existing where this corporation has its wealthy deposits. Zinc is selling at very high figures just now on account of its use in the manufacture of war munitions.

Autogenous Welding with the Oxy-Acetylene Blow Pipe*

By C. Royer **

Welding by means of the oxy-acetylene process is a method of repair, which can be adopted in connection with almost any description of metal work. The possibilities possessed by it as a manufacturing process have not, however, been fully recognized, and it is in this direction that further future developments of the art are most likely to take place.

THE successful application of autogenous welding in very many instances has proven to the industrial world the great utility of this process. The possibilities of this process are continually being demonstrated in hundreds of workshops, where its successful application in daily work indicates the almost unlimited field of usefulness which the future holds for it.

Electrical, Chemical and Autogenous Welding

Before proceeding with the subject of this lecture, it might be desirable to mention the subject of electric welding. Electric welding consists of the application of electrical energy in such a manner that the temperature of the work will be raised to the desired point in two ways, either by causing the work or certain parts of it to form a resistance circuit and be heated by the effort of the current in overcoming the resistance, or by striking an arc between a suitable electrode and the part of the work to be welded.

In the first case, the two parts to be welded are pressed together, and the current supplied through electrodes on either side of the contact joint, the resistance of which causes local heating of great rapidity, which soon reaches welding point, when the two parts are inseparably united at the point of contact.

*From a lecture given before the Metallurgical Society of McGill University, Montreal.
**Manager of L'Air Liquide Society, Montreal.

PATCH WELDED IN.

Spot welding is the best example of the resistance process, and is very serviceable where large quantities of similar parts are to be handled..

The arc process possesses some peculiar advantages, due to the fact that its rapidity of action serves to eliminate the large amount of expansion and contraction, which in some cases militate against the success of autogenous welding. The successful application of the arc-process depends largely on the type of apparatus, many of which have been designed, but all of which have not proved an unqualified success. The advantages of the arc process are sometimes offset by the changes which take place in the metal, the resulting difference between the welded region and adjacent parts being occasionally very marked in regard to such features as hardness, brittleness, and elongation.

INSTALLING FREEZING COILS WITH WELDED JOINTS IN AN ARTIFICIAL ICE SKATING RINK.

The Thermit Process

This is strictly a chemical process, and depends on the fact that when powdered aluminum is intimately mixed with iron oxide and a small portion heated to a suitable temperature, the aluminum combines with the oxygen and releases the iron. This reaction is accompanied by intense heat, the iron being turned into a molten mass, which is available for use in a welding mould, as used in scoop welding. Although limited in application, its reliability and capabilities render it indispensable in certain classes of repair work.

Blow Pipe Processes

The general use of the blow pipe as a means of welding is of comparatively recent occurrence, but it has firmly established itself as a recognized branch of industrial activity. Its most interesting features are the large variety of work which it can perform, and the number of different metals which can be united by means of it.

Comparatively little expense is involved in the installation of a plant for any particular line of work, while the fact that this process alone is capable of use on cast iron, steel, aluminum, copper brass, bronze, etc., renders it unique among welding processes.

Although several combustible gases

PATCH CUT OUT.

have been proposed for use in the blow pipe, experience has shown that acetylene gas is the most suitable.

BROKEN PRESS FRAME.

Oxy-Hydrogen Flame

The possibilities of oxygen and hydrogen for blow pipe work were first tried out on a commercial scale in 1901. The combustion of hydrogen in oxygen results in the generation of a large amount of heat, 350 British thermal units being released for every cubic foot of hydrogen consumed. At the same time, a proportion of water is formed in the shape of vapor.

Theoretically, two volumes of hydrogen and one volume of oxygen are necessary for perfect combustion. Practically, a flame of such composition is unsuitable for welding, due to the presence of water vapor, which is decomposed by contact with the hot metal; the oxygen combines with the metal to destroy its quality and impair the reliability of the weld. This action may be avoided to some extent by using an excess of hydrogen, in some cases 4 to 1, but this waste is accompanied by a lower flame temperature, so that except for very light sheet steel work the use of the oxy-hydrogen flame is almost discontinued.

Acetylene Gas

The use of acetylene gas had also been proposed in 1901, and its economy of operation, combined with its wide field of application, has resulted in its universal adoption by autogenous welders.

Acetylene is an endothermic gas which gives 1,630 British thermal units per cubic foot, 270 of which are due to the heat of dissociation. By weight, acetylene consists of 92.3 per cent. carbon and 7.7 per cent hydrogen. When one volume of acetylene is burned with one volume of oxygen, carbon monoxide and hydrogen are formed, and burn in the shape of a small bright cone in the centre of the flame. Towards the outer part of the flame these bodies combine with a portion of the oxygen of the atmosphere, presenting a different appearance from the central cone.

While $2\frac{1}{2}$ volumes of oxygen are theoretically necessary to burn one volume of acetylene, only one volume of oxygen need be supplied to the blow pipe, the atmosphere supplying the balance. The large proportion of carbon monoxide and free hydrogen in the oxy-acetylene flame have a reducing action, which renders the flame perfectly neutral and non-injurious to the work.

HEATING WITH BLOW-PIPE TO REMOVE PROPELLER

Autogenous Welding

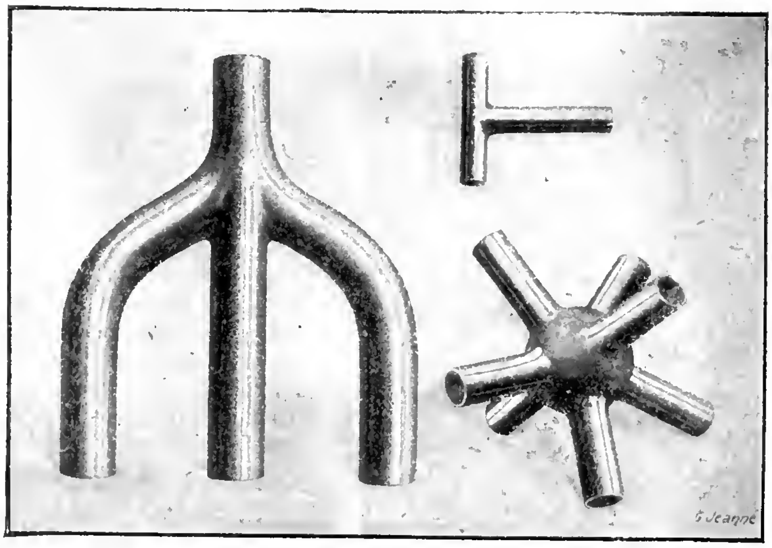
The use of combustible gases to generate heat in such a manner that it can be applied locally with a blow pipe or torch is the distinguishing feature of autogenous welding. The remarks which follow are based on the use of acetylene gas, combined with oxygen.

PRESS FRAME REPAIRED.

Oxy-acetylene welding is the art of so applying the heat of combustion to the work that a welding temperature is quickly obtained and maintained until the material is in a state of fusion, which then permits the union of surfaces or parts, the building up of areas, filling of cavities or hollows, the removal of metal, and cutting apart of various shaped bodies. Steel plates up to $1\frac{1}{2}$ inches in thickness and round or square bars up to 6 inches in diameter can be welded with the blow pipe without alteration to the chemical or physical characteristics of the material.

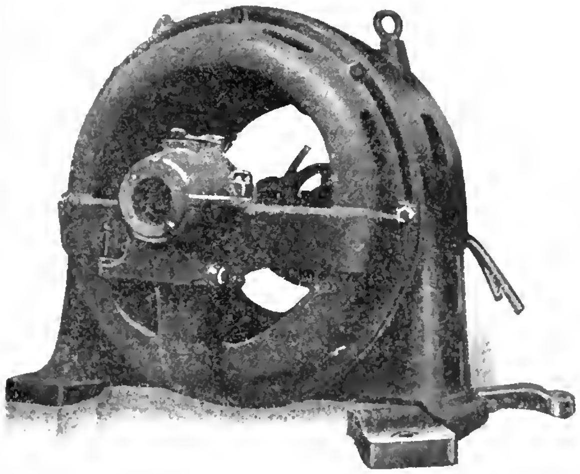
Oxy-Acetylene Equipment

The necessary equipment consists of a



BUILT UP COPPER PIPES

blow pipe with various size nozzles or burners, and a supply of oxygen and acetylene, the two gases being most conveniently handled when contained in steel tanks or cylinders.



BROKEN FOOT OF ELECTRIC MOTOR.

Compressed oxygen is readily obtainable in most industrial centres, while tanks containing dissolved acetylene are familiar to every automobile user. These tanks contain a porous substance saturated with acetone, which is a liquid possessing the power of dissolving or absorbing acetylene gas when supplied under pressure. As a result of this a greater quantity of gas can be stored at a less pressure, and in smaller space than when compressed alone. Generators are also used in which the acetylene gas is formed by the action of water on calcium carbide. They are desirable in large permanent installations, but for general work, the portable plant has many advantages.

Repair Work

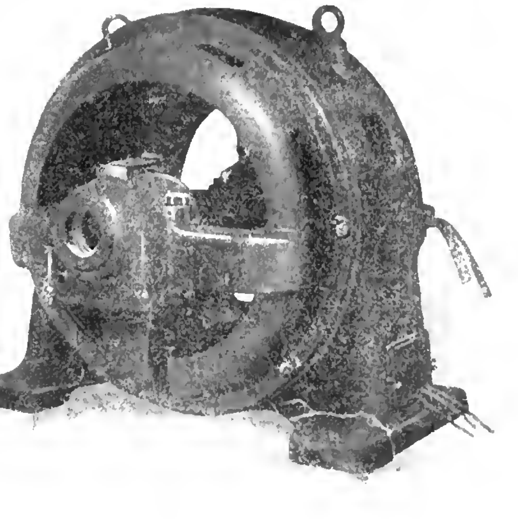
The most widely known field for welding is in repair work. In many cases repairs may be made in a few hours on parts, the replacement of which would require days and sometimes weeks. The indirect saving due to the none-stoppage of plants is frequently even more than the direct savings due to repairing instead of replacing.

Consideration must be given to all these features before deciding that a job can be profitably performed by welding. When heavy sections have to be operated on, the cost increases rapidly, while the effects of expansion and contraction have to be fully considered, carefully observed, and guarded against by various methods and devices.

Cast Iron

With suitable equipment and materials, a capable operator can weld cast iron parts, the joints between which will have a strength of more than 100 per cent. of the original material. This is due to the use of feed rods of better quality material than the work. In order to avoid hardness in the welds it is necessary to use feed rods rich in silicon, i.e., about 5 per cent., and take all precautions against too rapid cooling.

Cast iron, having no elongation, is not suited to withstand stresses produced by unequal heating, and in most cases it is necessary to preheat part or all of the work to be done. Even preheating does not always overcome this trouble with cast iron and much experience on the part of the

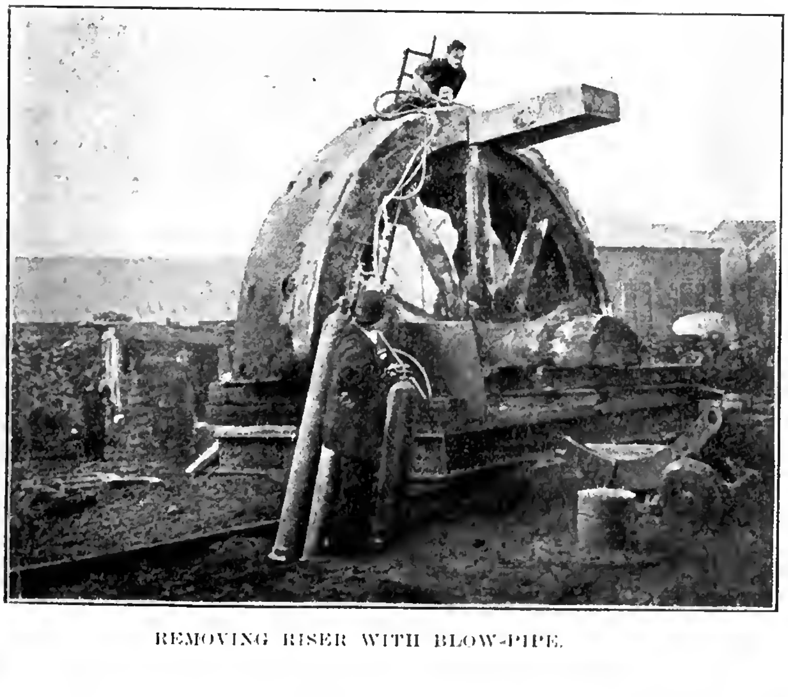


MOTOR WITH WELDED FOOT.

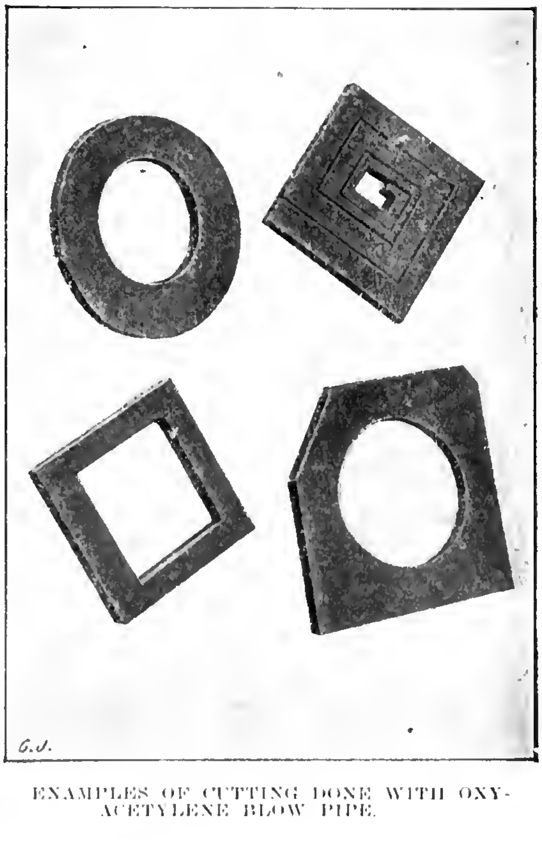
operator is required to insure the production of good work.

Steel

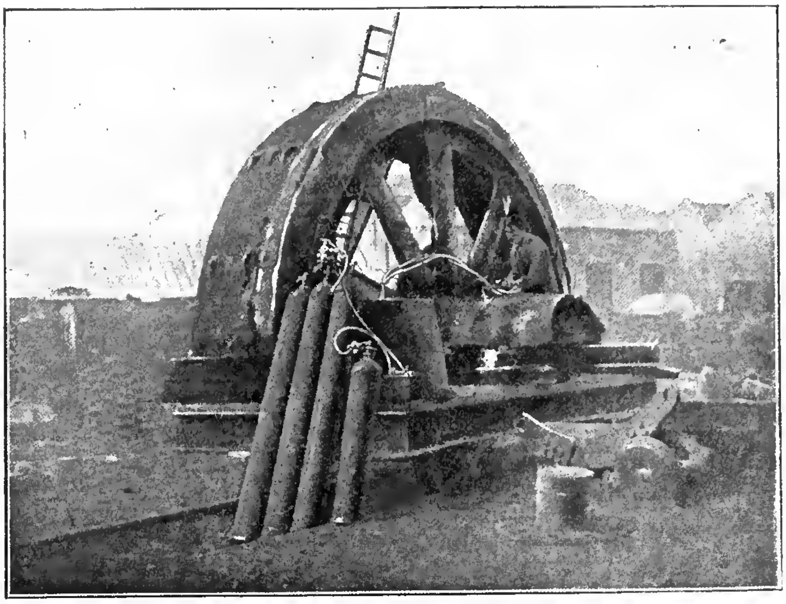
A proper weld in steel or wrought iron should always show above 85 per cent. of the original strength. The mere fact that an operator fuses a piece of feed rod and allows the drops to fall on comparatively cool metal does not constitute welding. It is only adhesion. A careful welder will have all surfaces at the required temperature, he will avoid the formation of oxide by controlling the



REMOVING RISER WITH BLOW-PIPE.



EXAMPLES OF CUTTING DONE WITH OXY-ACETYLENE BLOW PIPE.



CUTTING OFF HEAVY RISER.

flame, by the proper use of the hammer at the right moment he will improve the grain of the metal, and by further use of the blow-pipe, he can so anneal the work that the efficiency of the joint may be as high at 95 per cent.

In addition to cast iron and steel, oxy-acetylene welding is largely used for welding brass, bronze, copper, aluminum, and other metals. Its use in cutting up structural work such as bridges and buildings in course of demolition is a very great saving of time over the old laborious hand cutting. After heating a suitable spot on the plate or beam to melting point, the acetylene gas is turned off, and a stream of pure oxygen is played on the heated metal causing it to melt and at the same time generate enough heat to allow the action of the oxygen to be continued along the desired line until the piece is cut through.

The removal of risers and feeders in foundry work is an everyday application of the process.

Manufacturing Applications

The application of autogenous welding to the making of steel barrels, tanks, etc., has been carried out with considerable success, but a large field of usefulness has so far only been touched. For articles made of plate up to 3/8 inch thick it is very suitable, making a perfectly tight joint which requires no caulking, is cheaper than riveting, and presents a better appearance.

In the manufacture of steel and iron pipes, flat strips are rolled to shape and welded by an automatic machine. This process is used in making water and gas pipes, bicycle tubing and bedsteads.

By means of oxy-acetylene welding, water, steam and gas pipes have been reduced in thickness as threaded joints are eliminated. Many installations of complete systems have been made without a screwed joint, the joints being welded while in position. Very few fittings are required, as a hole can be cut in a pipe and a branch welded on. The welding of flanges to pipe is also another great advantage.

The construction of heating boilers by welding together parts made of steel plates, has been greatly developed also the construction of radiators by the same method. Other applications which can be made include the following:—

The construction of steel cars, doors, frames, window sashes, etc.

Poppet valves for internal combustion engines.

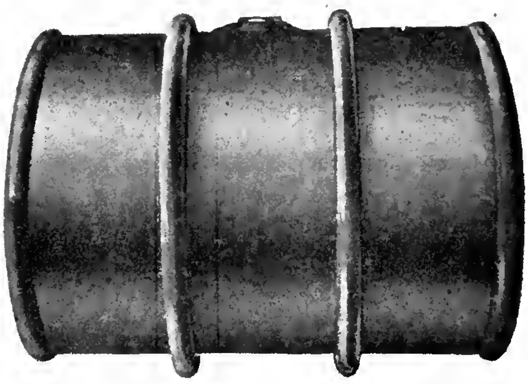
Cement pipe lines where the liners are shells of light gauge steel.

CUSTOMS RETURNS HIGHER

AN increase of over two millions in Customs receipts is the healthy condition shown by the figures issued for September by the Department of Customs.

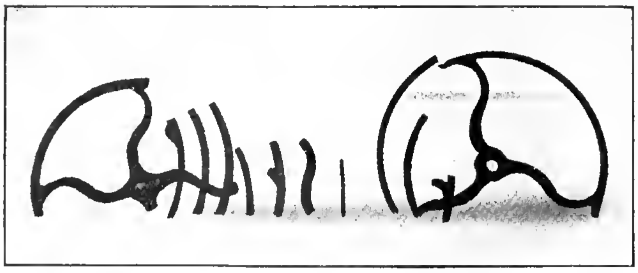
For the month, receipts totalled $8,029,665, as compared with $5,919,273 in September of last year, or an increase of $2,110,391. For the six months, ending September 30, of the present fiscal year, receipts have been $44,760,830, as compared with $43,044,913, an increase of $1,715,917.

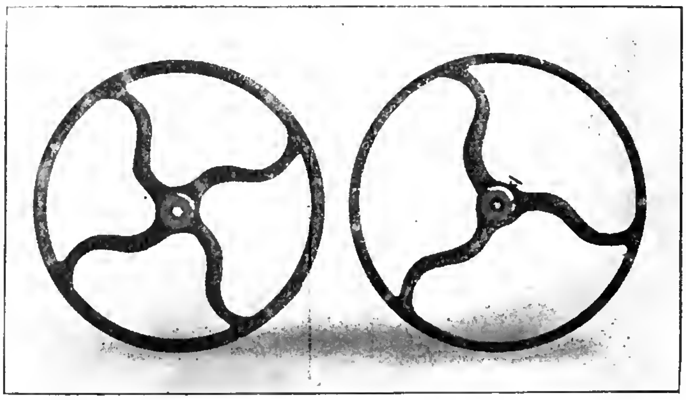
This indicates that for the first half of the 1915 financial year, at least, the Customs revenues have been swelled by the tariff increases of last season to the extent of almost two millions. As it usually takes some time before Customs taxes have their due effect, the showing for the last half of the year is expected to be even better. It must be remembered in comparing the first six months of this year with those of 1914 that the latter period includes but two months of war.



WELDED STEEL BARREL.

The pressure in the chamber of a gun at the moment of discharge of the shell is about 25 tons per sq. in.





PARTS OF BROKEN PULLEYS SUCCESSFULLY REPAIRED WITH BLOW-PIPE.

EDITORIAL CORRESPONDENCE

Embracing the Further Discussion of Previously Published Articles, Inquiries for General Information, Observations and Suggestions. Your Co-operation is Invited

MOLDING A LARGE ACCUMULATOR BASE

By J. H. R.

THE St. Lawrence Iron Foundry Co., of Montreal, Que., who make a specialty of supplying all kinds of iron castings to the trade are at the present time remodelling a portion of their plant and equipping same for the machining of 4.5 high explosive shells. They will, however, continue to develop the foundry end of their business, and in order to give your readers an idea of the nature and scope of same, the molding features connected with the production of a large accumulator base casting are here detailed and illustrated.

This casting, which will weigh in the neighborhood of 17,000 lbs., is for the base of one of the largest accumulators yet built in Canada, and which is being constructed for the Montreal Ammunition Co., by the Canadian Boomer & Boschert Press Co., of Montreal. The accumulator, when completed will furnish a pressure of 1,500 pounds per sq. inch to hydraulic presses engaged in the drawing of shell cartridge cases. The casting will consist of 25 per cent. steel, which is obtained from the use of the discarded shells and shell ends from shell making plants. The pattern for this base casting was of the skeleton type, being quite satisfactory in view of the fact that only one casting would be required.

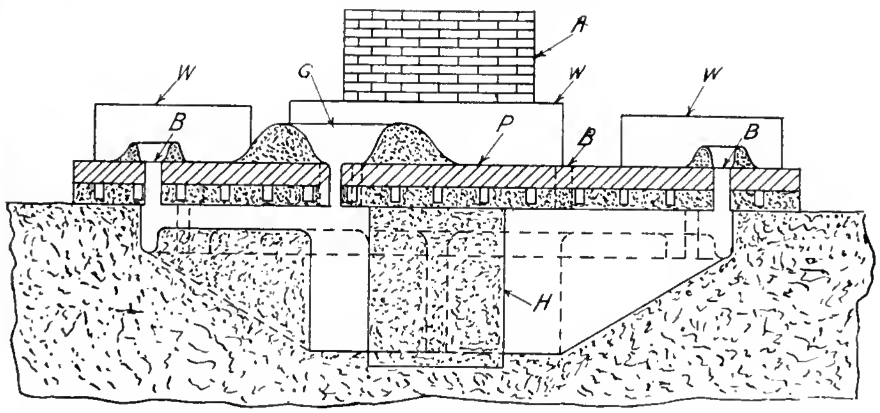


FIG. 1. SECTION THROUGH GREEN SAND MOLD FOR ACCUMULATOR BASE.

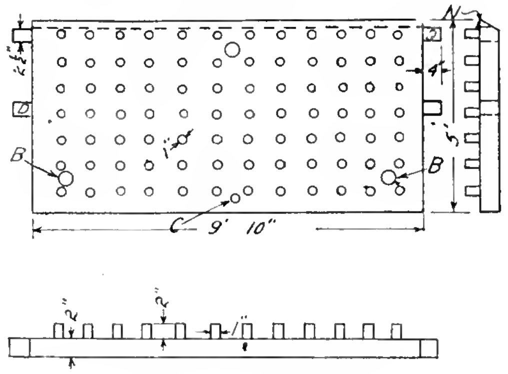


FIG. 3. COPE PLATES.

Preparing the Mould

The mould was prepared as shown in Fig. 1. A pit was dug in the floor and the pattern set into it, and levelled up. Green sand was shoveled in and thoroughly rammed, care being taken to have the sand of uniform density at all points. As there was no base to the pattern the openings between the ribs made it easy of access.

When the spaces between the ribs were completely rammed, the surplus sand was removed by sweeping the surface above the ribs leaving the space for the metal at the base of the casting. The sand having been levelled off, the pattern was carefully removed, the moulder and his helper afterwards cleaning up and smooth facing the various surfaces. A view of the mould at this stage is seen in Fig. 2. As it was not thought advisable to construct a special cope the method shown in the figure was adopted as this had proved satisfactory in former cases.

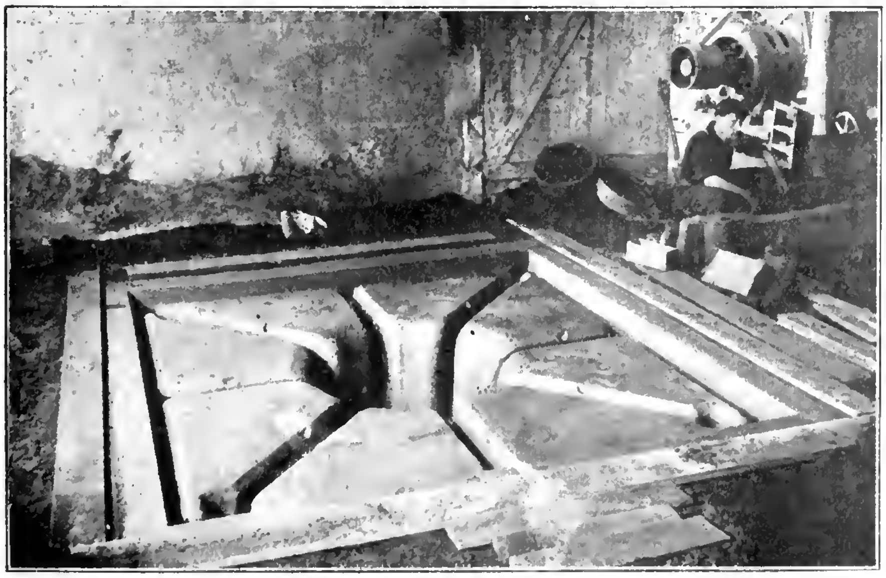


FIG. 2. COMPLETED GREEN SAND MOLD FOR ACCUMULATOR BASE.

Special Cope Plates

Two plates of cast iron weighing about 2 tons each and similar to that shown in Fig. 3 were cast. Pins A which protruded about two inches from

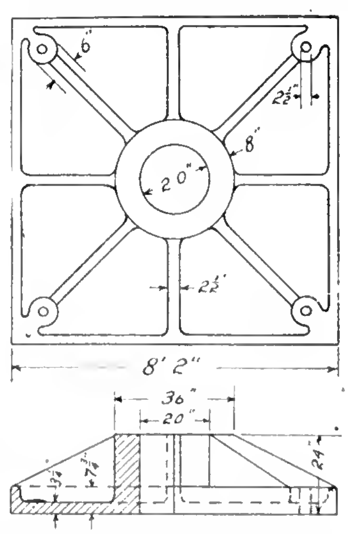


FIG. 4. ACCUMULATOR BASE.

the main plate and were about one inch in diameter were placed irregularly about the surface for the purpose of retaining a layer of sand spread over the surface and which was rammed up and surface levelled by placing the plate in the framework shown to the right is Fig. 6. This thickness of sand amounted to about $2\frac{1}{2}$ inches. Cored holes B were put into the plate so as to come directly over the corners of the casting and be just outside of the boss as shown in Fig. 4, which is a sketch of the finished casting. The holes C were for inserting eye-bolts for convenience in handling, while the lugs D, were used for turning the plate over when the sand facing was in place.

Arrangement of Mould

The arrangement of the mould for producing these plates, two of them being used, is shown in Fig. 5. A space sufficiently large was cleared on the floor and the sand rammed to an even density. A skeleton frame was used to make the required plate dimensions which were about two inches thick by nine feet ten inch by five feet. When placed over the mould as shown in Fig. 1 there was a bearing of 10 inches all around the edge.

The object of making two plates in place of one was for convenience in handling. It will be noticed that the plate edges which come together in the centre of the mould as shown at N are bevelled. This is for the purpose of securing a good close joint with little labor. When the plates are butted, the trough formed by the two bevels is rammade with a little waste and sand thus securing a close joint and avoiding fins or burrs, which would be liable to appear if the plates were left the full thickness at their edges.

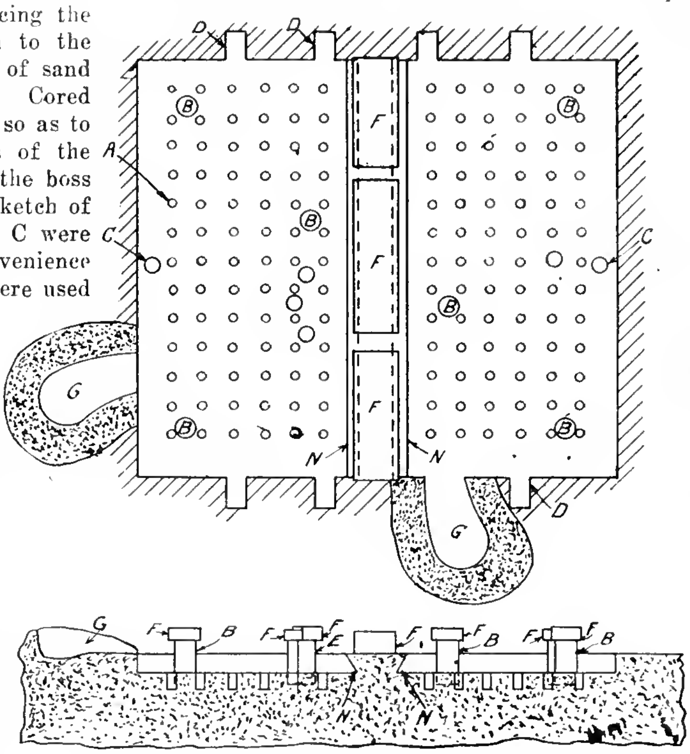


FIG. 5. GREEN SAND MOLD FOR COPE PLATES.

The layout of this mould is shown in Fig. 5. The cores B are for the risers while those at E were for the runners from the pouring basin when placed over the mould Fig. 1. The pouring basins G were placed to one side of the moulds. The cores were prevented from shifting by means of the weights F. A view of the mould in readiness for pouring is shown in Fig. 6.

Accumulator Base Casting Mould

A sketch of the mould for the accumulator base casting is seen in Fig. 1. After the mould is prepared as per Fig. 2, the plates with their facing of sand are placed in position and the basins for pouring and risers arranged. The weights W, together with that of the plates, amounted to about ten tons. The plates at the centre rested on the 20-inch cove H, which extended up level with the base of the cutting.

Pouring

The largest ladle in the shop which was handled by a 5-ton "Whiting" crane had a capacity of only 5 tons. It was, therefore, necessary to provide some means of continuous pouring. The brick bosh A shown at the rear of Fig. 1 was constructed of sufficient size to hold about 4 tons of iron and this was filled with molten iron while the 5-ton ladle

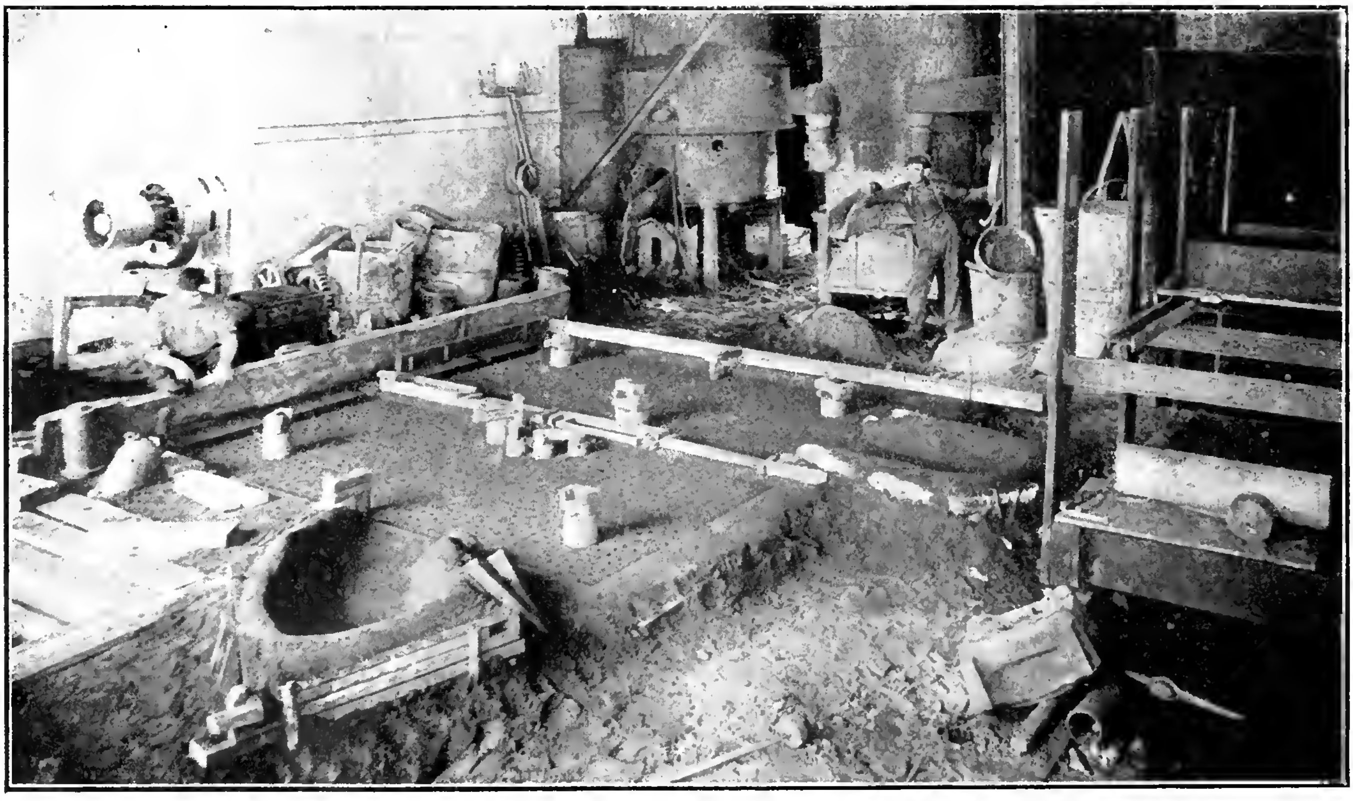


FIG. 6. GREEN SAND MOLD FOR COPE PLATES IN READINESS FOR POURING.

was being poured. When the 5-ton ladle was emptied, the bosh was tapped, and while the metal was running in the ladle was being refilled.

One of the problems which confronted the foundry foreman was the removal of the casting after cooling, as the 5-ton crane was not deemed capable of lifting a casting which was expected to weigh between 8 and 9 tons. One side was raised at a time by which process it was gradually turned over on to a track prepared with special rollers. It was then removed to the Canadian Boomer & Boschert Co. shops across the road in which the accumulator was to be erected and completed.

CONCERNING BELT SLIPPAGE

By N. G. Near.

ANSWERING R. McLaren, who says he is "still unconvinced that a slipping belt necessarily means fuel waste," I do not know how I could explain the matter more simply than by use of the hoisting engine.

This is the principle upon which all Prony brakes are made, and this principle is used in running all "Prony" brake tests. Therefore, when the slip of a belt becomes 100 per cent., the belt will not move the driven pulley at all and the whole arrangement becomes a veritable "Prony" brake.

With reference to the hoisting engine, Mr. McLaren says:

"We will assume that the weight is suspended from the drum by a cable and that the cable slips on the drum, the tension being adjustable in a manner similar to the brake band. We will assume also that the drum has a radius of 1 ft. and that it turns at the rate of 100 r.p.m. The power required to hold the weight stationary would be $(2 \times 1 \times 3.1416 \times 100) \div 33000 = 628.32$ h.p. How then would he cause the weight to rise?"

It is a fact that the weight of 33,000 pounds cannot be raised without some additional power because nothing can be set in motion from rest without the exertion of some force acting through distance. An additional hundredth, thousandth or millionth of a horse power will therefore be sufficient to raise the weight. To raise it "quickly" though, may require an additional 25 or 50 h.p., and this can easily be computed from the familiar formula, $F = Ma$, where F = force, M = mass, a = acceleration given to the 33,000 pound weight.

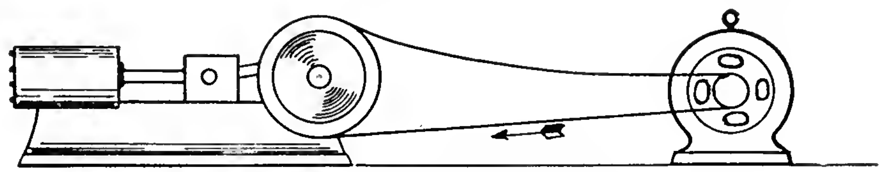
It is, therefore, evident that should the engineer so choose, and should he happen to have that amount of energy available, he could expend an additional 1,000 h.p. or more in raising the weight.

It is true, as Mr. McLaren says, that running the engine faster or increasing the tension in the cables, will accomplish the desired end, and either operation will require more steam.

No, I would hardly claim that it is easier to climb a stair than to walk along a level floor. When you climb a stair you store potential energy within yourself, and it requires work to do that, but when you walk along a level floor, the summation of all the work done by one's self on one's self is zero. No work is done at all.

The Gas Engine Example

As for the gas engine, let me explain in detail why each per cent. of belt slip on gas or gasoline engines represents a fuel loss of more than one per cent. I refer here only to gasoline engines that fluctuate violently.



CONCERNING BLLT SLIPPAGE.
When running, belt slip zero; tension in upper half belt, zero; tension in lower half belt, 1,000 pounds.

The tension in the belt here is 1,000 pounds only because the load does not require a greater tension. Should the load be greater, the tension would of itself become more than 1,000 pounds, and there would be no slip, but, there is a limit. Let us suppose that the belt slips at 1,100 pounds. This tension is reached when the engine "jerks," due to the sudden explosions, and, during the instant of slip, the tension of 1,100 pounds is doubtless maintained. More energy is being taken from the engine, then, during the instant of slip than during an instant of normal pulling, and I therefore naturally conclude that the full consumption is greater, due to slip, than if there were no slip.

The best way to eliminate this loss is to make the fly-wheels so heavy that the fluctuations will not be violent enough to cause belt slip, or, the explosions may be made frequent enough to produce the same effect.

I trust I have now made myself perfectly clear.

POINTS ON RUBBER BELT CONSTRUCTION

BRIEFLY, the process of belt manufacture is as follows:—Cotton duck, of such weight and strength as is required for the work to be done, is frictioned or coated with rubber upon the calender. The quality of the rubber, like the weight and strength of the cotton, varies according to the nature of work to be done. The frictioned fabric is then cut into definite widths, according to the width of the finished belt, after which the plies of fabric are built up either by folding or laying ply upon ply or a combination of both.

After the belt is built up and the cover applied, a seaming strip of high-grade rubber is laid over the outside joint in order to weld this joint firmly together and prevent separation or opening up of the seam. The raw belt is then rolled upon a shell and given a slight cure in open heat in order to vulcanize the edges. After the "first cure" the belt is carefully vulcanized between the polished plates of a powerful hydraulic press. The rubber is forced into the duck, and the whole belt becomes perfectly smooth and firm. Just prior to vulcanizing, the belt is stretched under great pressure, thus minimizing stretch when the belt is put in actual use.

Rubber belts should be run at not less than 200 ft., nor over 5,000 ft. a minute, a good average being 2,000 ft. Shifters should not be used, as, once the edges of rubber belting are worn through, the plies readily separate. All animal oils and greases are injurious to rubber belting.—Practical Engineer.

BRITISH EXPORTS TO CANADA DECREASE

THE following are the official figures from London, of trade between Canada and Great Britain in the undermentioned articles during August:—

Imports From Canada

	Aug. 1915	Aug. 1914
Wheat	£282,380	£1,506,011
Wheatmeal and flour	238,132	147,889
Barley	78,984	85,797
Oats	29,481	97,395
Bacon	278,791	129,404
Hams	49,392	21,380
Cheese	700,012	723,930
Canned Salmon	115,392	2,948
Canned lobsters	28,964	53,622

Exports to Canada

Spirits	£ 29,959	£ 54,359
Wool	15,650	16,767
Pig iron	665	869
Wire	983	2,948
Galvanized sheets	5,118	18,241
Tinned plates	2,099	5,403
Steel bars	4,494	7,134
Pig lead	849	4,050
Cutlery	5,429	6,037
Hardware	2,370	10,596

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Machine, Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

SHELL MACHINERY IN FRANCE

THE fact that the French nation is mobilized to a man for the purpose of producing shells as well as actual fighting is of particular interest to our readers at the present moment. Our allies were alive to the necessity for extraordinary shell production long before it was realised by ourselves, and the efficient manner in which munitions manufacture was tackled and made a national problem has already earned the admiration of not a few British engineers.

Previous to the outbreak of hostilities, the firm of Alfred Herbert, Ltd., of Coventry, Eng., enjoyed a widespread business with various European nations, but since then, their activities have been limited to certain countries. One of their travelling operators in France has done excellent work in the designing of shell machinery which has been made by the firm's customers in France. His description of conditions and methods which we reproduce are from the house organ of Alfred Herbert Ltd.

In the first place the various works in the country were grouped, the shops in each group working in conjunction with each other, while an expert engineer was put in control of the group.

Contracts were then given out to the controller of each group, who divided and sub-divided the work amongst the establishments under his control, according to the capacity of each shop. Machine tools changed hands according to the work given out; for instance, a particular shop had a few automatic machines, but not enough to undertake a large contract for shell bodies. These automatics were thereupon transferred to another shop which had more of the same type, while the latter sent some of its smaller machines to the first.

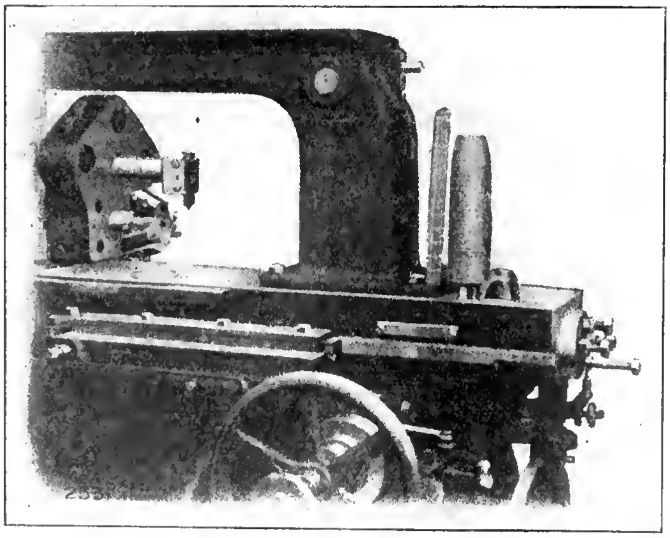


FIG. 1. 75 MM. H. E. SHELL, WITH SECTION CUT FROM NOSE.

With a large number of automatic machines, the second shop could turn out a large number of shell bodies in an efficient manner, while the first shop was put into better shape for handling fuses and grenades.

At the same time, it was no easy matter to switch all these works over from building motor cars, locomotives, etc., to shell and gun production. Tools were a great problem, but it was not allowed to remain a problem long. One or more works in each group was told off to act as a sort of tool room to the rest, a plan that has worked very satisfactorily.

Automatic machines are not being used for turning and boring shell bodies to any great extent in this country, but our French allies have turned to account any and every machine they could lay their hands on.

Although we are not allowed to mention names, it is by the courtesy of the controller of one of the aforementioned groups, that we are permitted to publish the accompanying illustrations with particulars of the tools used for producing 75 mm high explosive shells on our Nos. 4 and 6 Automatic Turning Machines.

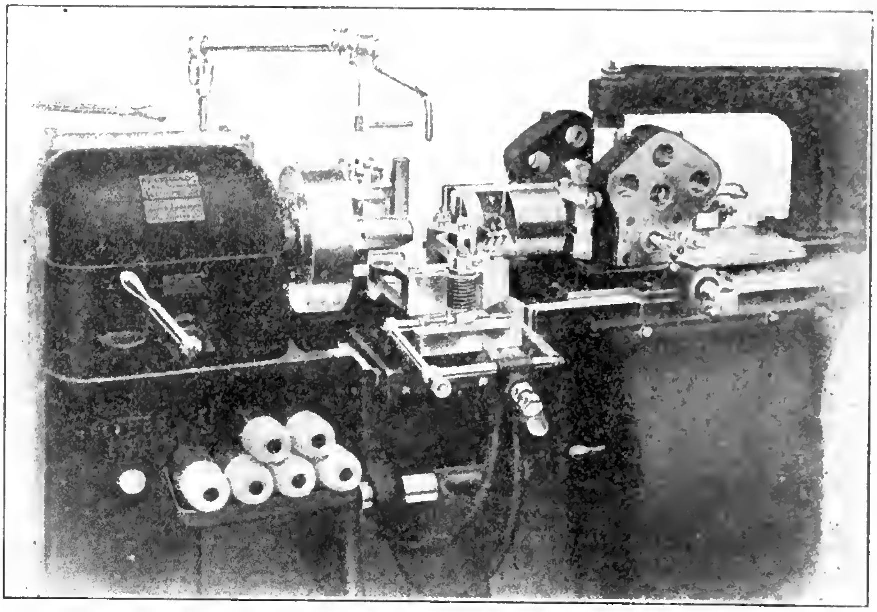


FIG. 2. ROUGHING BOX TOOL AND PROFILER.

The French 75 mm high explosive shells are made from forgings. These are first rough turned and finish bored previous to a closing-in operation. After the nose has been closed-in the shell bodies are delivered to the Automatic Turning Machines for the finishing operations. It should be noted that during the first rough-turning operation, the boss at the closed end of the shell is turned to a definite size with limits either way of 0.008 inches.

This boss is made use of after the closing-in operation, for holding the shell body true in the chuck.

In the first operation on the Automatic, the shell body is held in soft jaws, mouth outwards, while a special draw-in chuck fitted in the spindle, grips and holds true the boss on the end of the shell.

The shells are located by the bottom of the hole, using a device that gives a definite length from this point to the front of the chuck jaws.

The box-tool shown in position in Fig. 2 first turns the shell body to about half way down. The special radius tool

fixed to the front cross-slide is then fed forward by the roller device seen on the next turret face. At the same time the mouth is reamed. This operation is seen in Fig. 3.

This illustration also shows the special recessing tool used for boring and dovetailing the mouth. Owing to the necessity for fitting the profiling tool to the front cross-slide, this recessing tool has to be fed by the rear cross-slide. It was, however, found necessary to have the tool inverted so that the spring and lever feed reversing mechanism seen in the illustration, Fig. 3, was adopted, and works very well.

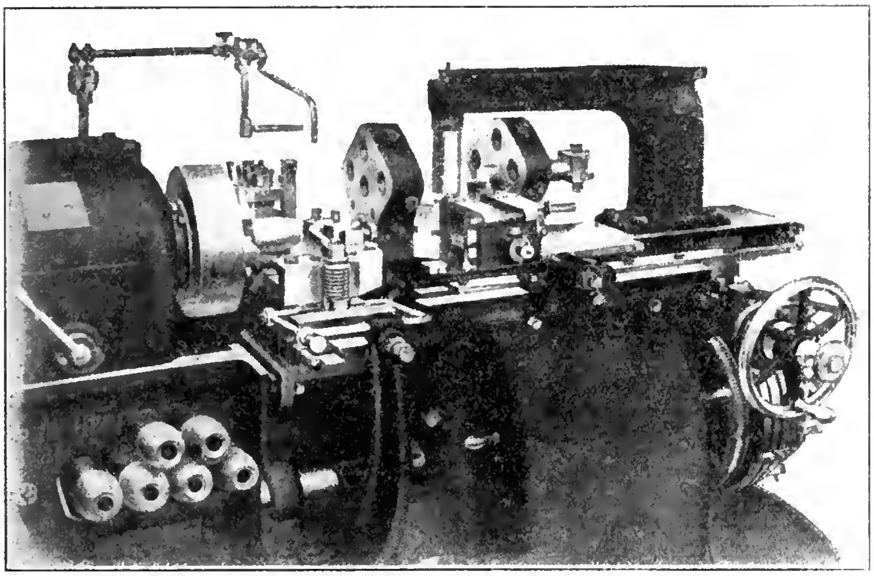


FIG. 3. PROFILING TOOL IN OPERATION.

In the second operation the rear portion of the shell is finished. Owing to the manner in which the lengthwise limits of the shell are specified, it was found impracticable to locate the shell by the mouth; the best way and the one adopted is to fit a bush in the machine spindle, boring this out to suit the profile of the shell nose. The shell is then pushed into this bush and gripped by soft jaws in the chuck. Centring and locating the shell in this manner by the finish-turned nose effectually prevents the shell from running out of truth.

The outside diameter is first finish turned with tools in the turret. The band groove is cut by a tool in the rear cross-slide and the outside of the shell between the band groove and the closed end is then turned taper by means of the profiling slide seen in Fig. 4, and a taper former carried in the front cross-slide.

The special knurling apparatus, seen in Figs. 4 and 5, is then used for serrating the bottom of the band groove.

The total time for both operations, including chucking and removing, is 17 minutes, the speed at which the shells are turned being approximately 66 feet per minute.

The roughing tools used last for about 30 shells, while the finishing cutters will machine 60 or more before they require re-grinding.

Re-setting the tools after sharpening takes 10 minutes for the roughers and 15 minutes for the finishers. This gives a total output of about 38 shells per day of eleven hours per machine.

Automatic Turning Machines are also being employed on the first operation on 105 mm shells in a similar manner to that described for the first operation on 75 mm shells.

For profiling the nose however, it is necessary to take two cuts, roughing and finishing. These two cuts take place simultaneously, a double slide arrangement being mounted on the turret, the two slides being guided by formers held in the front and rear cross-slides.

Although there is about half an inch of metal to remove near the nose end of the shell, this operation is completed in 20 minutes.

GLASSES FOR EYE PROTECTION

DEMANDS for adequate eye protection are becoming more insistent with the widespread use of apparatus for such processes as oxy-acetylene welding, electric furnaces of various types, and all metal manufacturing processes which involve the exposure of operators to direct heat and light rays of considerable intensity. In a report on investigations regarding the provision of suitable glasses for eye protection, in a recent issue of the Iron Trade Review, M. Luckiest, of the National Lamp Works, presents a number of interesting facts relative to light and its control.

The energy which is radiated from all hot bodies into the surrounding media is sent forth impulses or waves. In a manner similar to that of a wireless receiving station, the eye is physically capable of perceiving pulses or waves of a certain definite frequency or length, name from 0.39 micron to 0.75 micron, a micron being a small unit of measurement equivalent to one one-thousandth

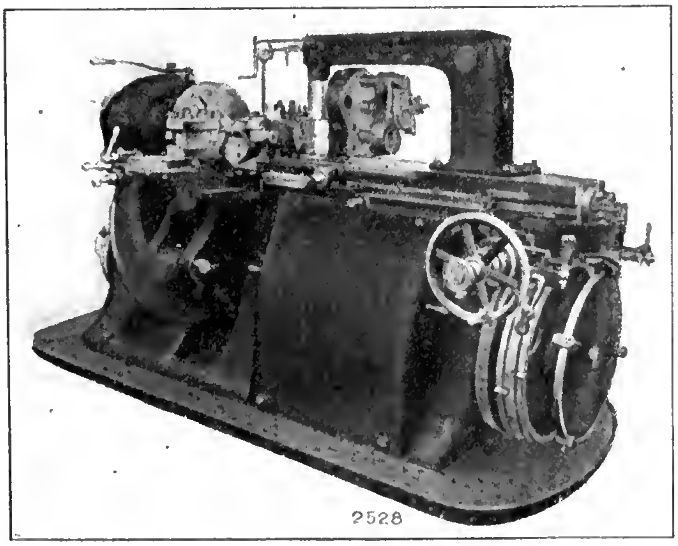


FIG. 4. TAPER TURNING AND KNURLING.

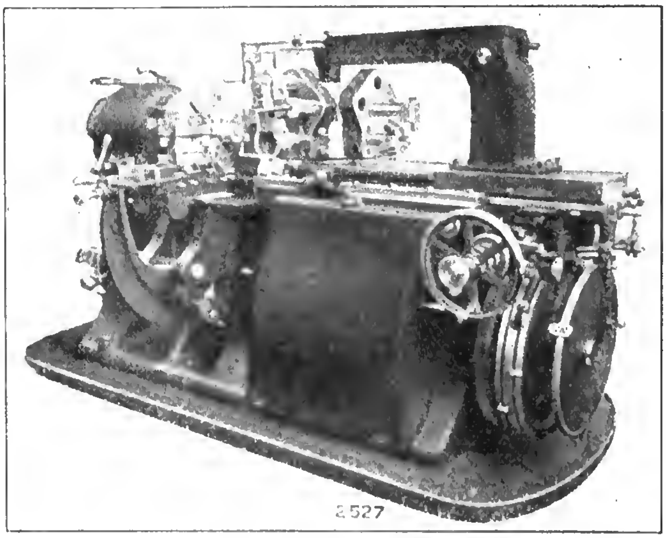


FIG. 5. SHOWING KNURLING AND ROUGHING TOOLS.

of a millimeter. These limits constitute what is known as the region of visible spectrum.

Various Kinds of Rays

A hot body before it has reached a sufficiently high temperature to become luminous, gives off only what are commonly known as "heat" rays. As a matter of actual fact, all rays, whether visible or invisible, when absorbed by a medium, produce heat in that medium. As the temperature is increased, visible rays begin to emanate from the heated body. Further increases in temperature cause ultra-violet or chemical rays to emanate, the relative amount of the various kinds of rays emitted depending not only on the temperature of the body, but also on the substance of which it is composed.

The ultra-violet rays, that is those of shorter wave length than 0.39 micron, have no illuminating power. Certain varieties of them however are very active in destroying animal tissue. Complete data regarding them has not been obtained, but their harmful properties render it desirable to prevent any of these rays from entering the eye.

The retina or nerve surface of the eye can also be damaged by focussing excessive amounts of energy upon it. The selection of suitable glasses therefore involves two important features besides the provision of mechanical strength, viz. ultra-violet rays should be prevented from falling upon the eye, and the intrinsic brightness of the image thrown into the eye should be reduced to safe limits.

Very few glasses totally absorb the ulta-violet rays, and these are objectionable owing to the strong coloring in them. Yellow-green is the most desirable color.

Heat rays should be prevented from entering the eye because it is suspected that eye fatigue arises from the absorption of excessive heat. A desirable feature of the yellow-green glass is the fact that variations of brightness due to the changes in temperature of incandescent bodies have the same relative appearance to the eye when using this glass, as when using uncolored glass. This fact accounts for the satisfaction experienced by welders when judging temperatures through these glasses.

Common smoke glasses simply reduce the amount of light, but do not absorb the unsafe ultra-violet rays. A variety of glass known as Akopos has been found which absorbs all of these rays, and can be combined with other glasses which are necessary to reduce undue brightness.

The appended table gives designations of safe glasses for various metallurgical processes.

Process.	Temperature degrees Fahr.	Safe glasses.
Electric arc	6,200	Ak.+E.S.
Electric arc under pressure	6,450	Ak.+E.S.
Oxy-hydrogen flame	3,600	Ak.+S.16
Oxy-acetylene flame.	4,350	Ak.+S.20
Thermit weld flame.	4,500	Ak.+S.20
Metal at tuyeres, and furnaces	3,500	Ak.+S.16
Metal at tuyeres, blast furnaces	2,300–2,800	Ak.+S.12
Open hearth furnace flame	3,400–3,600	Cobalt Blue
Bessemer converter.	3,400–3,600	Ak.+S16
Open-hearth in ladle	2,800–2,900	Cobalt Blue
Bessemer	2,800–2,900	Ak.+S.12
Soaking pits, low carbon	2,500–2,600	Ak.+S.12
Soaking pits, high carbon	2,200	Ak.+S.12
Gasheating furnaces	2,400–2,800	Ak.+S.12
Large gasheating furnace	2,900–3,200	Ak.+S.14

Ak. is an abbreviation for Akopos: E.S. S 16, etc., are opticians' designations for glasses of various shades.

TAPER FUSE THREADS

FUSE adapter bushes of naval lyddite shells have a taper hole in them cut 14.083 threads per inch. In the 6-in. shell, the length of this thread is about 2 in., and it is quite impossible to get anything like a satisfactory job on so long a thread by using taps, as each of the cutting edges on the tap leaves a line where it stops cutting, and there is a danger of breaking the tap by running in too far.

For handling fuse adapter bushes on "Herbert" No. 4 capstan lathes, taper turning and chasing attachments, Fig. 1, are employed for cutting the thread. Previous to being chased, the hole is finished with taper reamers. The chasing attachment is shown in position in the illustration.

In action, the lathe spindle is run reversed and the chaser travels out from the work, operating in conjunction with the quick withdraw motion of the patent chasing saddle. The actual thread cutting is very rapid, taking approximately 40 seconds for a thread of 2 in. long, whilst the finish and accuracy obtained is excellent.

The corresponding male portion is screwed with a 1¼-in. "Coventry" patent self-opening diehead, fitted with the taper threading attachment shown in Fig. 2. The taper is governed by a former bar, which is forced outwards by a spring, and kept stationary by a stop held in the tool post of the lathe, while the diehead travels forward.

The advantage of cutting taper threads by this method is that the work is finished quite smooth and round, without the four ridges left by taper dies where they cease cutting.—Herbert's Monthly.

As men improve in the service they render, their incomes should improve; they should be paid in proportion to the ability they show in the development of the business, whether it is an improvement in quantity or quality or both.

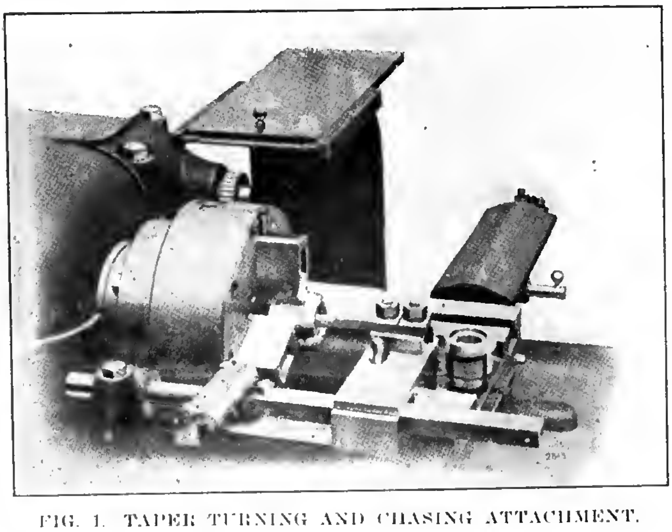


FIG. 1. TAPER TURNING AND CHASING ATTACHMENT.

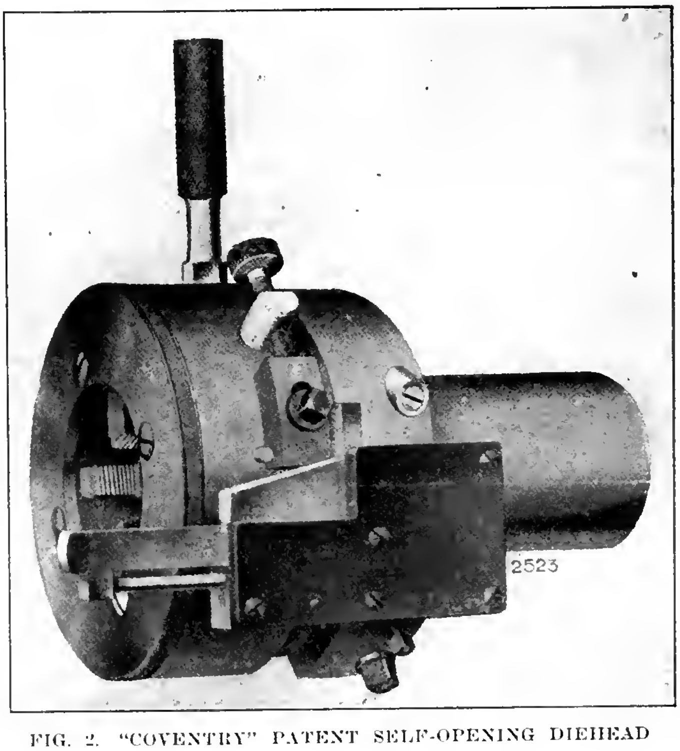


FIG. 2. "COVENTRY" PATENT SELF-OPENING DIEHEAD

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SCIENCE OR COMMON-SENSE?

THE beginning of the winter session of studies in the many technical schools throughout the country brings into increasing prominence every year, the subject of technical education. It is not very many years since discussions centered on the question, rather than the subject of technical education. People, especially employers, looked askance at the benefits which the rising generation of workers were supposed to be deriving from those institutions, and the practical value of the training, to the employer at any rate, was assessed at what, to the student, was a discouragingly low value.

The recent opening of the new Toronto Central Technical School marks what may well be regarded as a climax in the development of technical education. Quite apart from the magnificence and completeness of the institute as an educational plant, the significance of the event, as marking a further advance toward ultimate national efficiency, should make a deep and lasting impression on those manufacturers whose future prosperity and welfare will be largely dependent on the efficiency of the employees of the next generation.

By a peculiar coincidence, the recent meeting of the British Association for the Advancement of Science took place at Manchester almost simultaneously with the opening of the school in Toronto. As representing what might be turned the extremes of scientific knowledge the two events offer one of those contrasts which are characteristic of an age of advancement.

Knowledge feeds upon itself, and will not be suppressed. Ambition is the fruit of knowledge and a nation with no ambition is destined to ultimately sink into oblivion. Unguided ambition becomes recklessness, and when indulged in on a national scale induces catastrophe.

Professor Arthur Schuster, F.R.S., delivered his presidential address to the British Association on the subject of "The Common Aims of Science and Humanity." Although a man of German extraction, his deservedness of such a high honor was fully recognized by the authorities, and the subject matter of his address discloses a mind bereft of all traces of "kultur" and possessed of that receptive, analytical and constructive ability which is truly characteristic of the British scientist.

If it were possible to speak individually to the many thousands of young minds who at the present moment are digging into the rudiments of science with all the enthusiasm born of youth and novelty, advice for each one could be found in Dr. Schuster's Address.

In discussing the question of scientific success, he quotes a previous president who used these words regarding the qualifications necessary to make a man a great scientist: "But, I hear someone say, these qualities are not the particular attributes of the man of science, they may be recognized as belonging to almost everyone who has commanded or deserved success, whatever may have been his walk in life. That is so. That is exactly what I would desire to insist, that the men of science have no peculiar virtues, no special powers. They are ordinary men, their characters are common, even commonplace. Science, as Huxley said, is organized common-sense, and men of science are common men drilled in the ways of common-sense."

The student who wishes to attain success and all the happiness that accompanies the attainment of objects sought, will find his path smoothed, his interest sustained, and his accomplishments increased just so long as he remembers that his successes must be based on common-sense.

We commend a study of the Address to all thoughtful students at this time, and offer these few lines from it as representing sentiments which are worthy of assiduous cultivation:

. . . "the object of science is to economize thought, just as it is the object of a machine to economize effort. Logically, this definition is justified, and it may be the best that can be given, if we prefer using a technical expression to confessing an emotional feeling. But why should we do so? Is it not better to recognize that human intelligence is affected by sentiment as much as by reasoning? It is a mistake for scientific men to dissociate themselves from the rest of humanity by placing their motives on a different, and at the best only superficially higher level."

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey forge, Pittsburgh		$14 70
Lake Superior, charcoal, Chicago		15 75
Ferro Nickel pig iron (Soo)		25 00
	Montreal.	**Toronto.**
Middlesboro, No. 3	22 00	.....
Carron, special	23 00	.....
Carron, soft	23 00	.....
Cleveland, No. 3	22 00	.....
Clarence, No. 3	22 50	.....
Glengarnock	26 00	.....
Summerlee, No. 1	28 00	.....
Summerlee, No. 3	27 00	.....
Michigan charcoal iron	26 00	.....
Victoria, No. 1	23 00	20 50
Victoria, No. 2X	22 00	20 50
Victoria, No. 2 plain	22 00	20 50
Hamilton, No. -	22 00	20 50
Hamilton, No. 2	22 00	20 50

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	2.20
Steel bars, f.o.b., Toronto	2.20
Common bar iron, f.o.b., Montreal	2.20
Steel bars, f.o.b., Montreal	2.20
Twisted reinforcing bars	2.20
Bessemer rails, heavy, at mill	1.25
Steel bars, Pittsburgh	1.30
Tank plates, Pittsburgh	1.30
Beams and angles, Pittsburgh	1.30
Steel hoops, Pittsburgh	1.50
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.10
Small shapes	2.35
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.90
Structural shapes	1.95
Plates	1.95

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ¼ to ½ in., 100 lb.	$2 35	$2 25
Heads, per 100 lb.	2 55	2 45
Tank plates, 3-16 in.	2 60	2 45

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$12 25	$12 50
Copper, crucible	14 25	14 00
Copper, unch-bled, heavy	14 25	14 00
Copper, wire, unch-bled.	14 25	14 25
No. 1 machine compos'n	11 50	11 50
No. 1 compos'n turnings	9 00	9 00
No. 1 wrought iron	9 50	9 00
Heavy melting steel	8 00	8 00
No. 1 machin'y cast iron	13 50	11 00
New brass clippings	11 00	11 00
No. 1 brass turnings	9 00	9 00
Heavy lead	4 50	4 50
Tea lead	$ 3 25	$ 3 50
Scrap zinc	10 50	9 50

W. I. PIPE DISCOUNTS.

Following are Toronto jobbers' discounts on pipe in effect Aug. 27, 1915:

	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
Standard				
¼, ⅜ in.	63	38½	....	....
½ in.	68	47½	....	....
¾ to 1½ in.	73	52½	....	....
2 in	73	52½	69	48½
2½ to 4 in	73	52½	72	51½
4½, 5, 6 in.	....	....	70	49½
7, 8, 10 in.	....	....	67	44½
X Strong P. E.				
¼, ⅜ in.	56	38½	....	....
½ in.	63	45½	....	....
¾ to 1½ in.	67	49½	....	....
2, 2½, 3 in.	68	50½	....	....
2 in.	....	....	63	45½
2½ to 4 in.	....	....	63	48½
4½, 5, 6 in.	....	....	66	48½
7, 8 in.	....	....	59	39½
XX Strong P. E.				
½ to 2 in.	44	26½	....	....
2½ to 6 in.	....	....	43	25½
7 to 8 in.	....	....	40	20½
Genuine Wrot Iron.				
⅜ in.	57	32½	....	....
½ in.	62	41½	....	....
¾ to 1½ in.	67	46½	....	....
2 in.	67	46½	63	42½
2½, 3 in.	67	46½	66	45½
3½, 4 in.	....	....	66	45½
4½, 5, 6 in.	....	....	63	42½
7, 8 in.	....	....	60	37½

Wrought Nipples.	
4 in. and under	77½%
4½ in. and larger	72½%
4 in. and under, running thread	57½%
Standard Couplings.	
4 in. and under	60%
4½ in. and larger	40%

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65%
Sq. Head Set Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45%
Flat & But. Head Cap Screws	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in. N.	70%
Semi-Fin. Nuts up to 1 in.	70%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

METALS.

	Montreal.	Toronto.
Lake copper, carload	$20 00	$19 50
Electrolytic copper	20 00	19 25
Castings, copper	19 75	19 00
Tin	39 00	38 00
Spelter	18 00	18 00
Lead	6 15	6 25
Antimony	35 00	35 00
Aluminum	52 00	55 00

Prices per 100 lbs.

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh	$24 50
Openhearth bilets, Pittsburgh	25 00
Forging billets, Pittsburgh	33 00
Wire rods, Pittsburgh	30 00

NAILS AND SPIKES.

Standard steel wire nails, base	$2 40	$2 35
Cut nails	2 50	2 70
Miscellaneous wire nails	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	75
Stove bolts	80
Plate washers	40
Machine bolts, ⅜ and less	70
Machine bolts, 7-16 and over	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes	4¼c per lb. off
Nuts, Hexagon, all sizes	4¾c per lb. off
Iron rivets	72½ per cent.
Boiler rivets, base, ¾-in. and larger	$3.75
Structural rivets, as above	3.75
Wood screws, flathead, bright	85, 10, 7½, 10 p.c. off
Wood screws, flathead, Brass	75 p.c. off
Wood screws, flathead, Bronze	70 p.c. off

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Standard. Price. per ft.	Extra Strong, Sizes Ins.	Extra Strong, Price per ft.	D. Ex. Strong, Size Ins.	D. Ex. Strong, Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.....
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....

COKE AND COAL.

Solvay Foundry Coke	$5.75
Connellsville Foundry Coke	5.00
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

COLD DRAWN STEEL SHAFTING.

At mill	45%
At warehouse	40%

Discounts off new list. Warehouse price at Montreal and Toronto.

MISCELLANEOUS.

Solder, half-and-half	0.22½
Putty, 100-lb. drums	2.70
Red dry lead, 100-lb. kegs, per cwt.	9.65
Glue, French medal, per lb.	0.18
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.18
Benzine, single bbls., per gal.	0.18
Pure turpentine, single bbls.	0.64
Linseed oil, raw, single bbls.	0.72
Linseed oil, boiled, single bbls.	0.75
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Lead wool, per lb.	0.10
Pure Manila rope	0.16
Transmission rope, Manila	0.20
Drilling cables, Manila	0.17
Lard oil, per gal.	0.73
Union thread cutting oil	0.60
Imperial quenching oil	0.35

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto 40%

PROOF COIL CHAIN.

¼ inch	$8.00
5-16 inch	5.35
⅜ inch	4.60
7-16 inch	4.30
½ inch	4.05
9-16 inch	4.05
⅝ inch	3.90
¾ inch	3.85
⅞ inch	3.65
1 inch	3.45

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	60
Carbon over 1½ in.	25
High Speed	
Blacksmith	60
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Centre	25
Pipe Reamers	80

Discounts off standard list.

IRON PIPE FITTINGS.

Canadian malleable, A, 25 per cent.; B and C, 35 per cent.; cast iron, 60; standard bushings, 60 per cent.; headers, 60; flanged unions, 60; malleable bushings, 60; nipples, 75; malleable, lipped unions, 65.

TAPES.

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3.50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$2 70	$2 70
Canada plates, dull, 52 sheets	3 15	3 15
Canada Plates, all bright	4 75	4 75
Apollo brand, 10¾ oz. galvanized	6 40	5 95
Queen's Head, 28 B.W.G.	6 00	6 25
Fleur-de-Lis, 28 B. W. G.	5 75	5 75
Gorbal's Best, No. 28	6 00	6 00
Viking metal, No. 28	6 00	6 00
Colborne Crown, No. 28	5 38	5 30
Premier No. 28	5 60	5 50

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$11 00	....
1¼ in.	11 00	....
1½ in.	11 00	....
1¾ in.	11 00	....
2 in.	11 50	8 75
2¼ in.	13 00	10 50
2½ in.	14 00	11 15
3 in.	16 00	12 10
3½ in.	20 00	14 15
4 in.	25 50	18 00

Prices per 100 feet, Montreal and Toronto.

WASTE.

WHITE.	Cents per lb.
XXX Extra	0 11
X Grand	0 10½
XLCR	0 09¾
X Empire	0 09
X Press	0 08¼
COLORED.	
Lion	0 07½
Standard	0 06¾
Popular	0 06
Keen	0 05½
WOOL PACKING.	
Arrow	0 16
Axle	0 11
Anvil	0 08
Anchor	0 07
WASHED WIPERS.	
Select White	0 08½
Mixed Colored	0 06¼
Dark Colored	0 05¼

This list subject to trade discount for quantity.

BELTING RUBBER.

Standard	50%
Best grades	30%

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50%
Standard	50 & 10%
Cut leather lacing, No. 1	$1.20
Leather in sides	1.10

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	$9.00
¼ in.	6.25
5-16 in.	4.65
⅜ in.	4.00
7-16 in.	4.00
½ in.	4.00

Prices per 100 lbs.

PLATING CHEMICALS.

Acid, boracic	$ .15
Acid, hydrochloric	.05
Acid, hydrofluoric	.06
Acid, Nitric	.10
Acid, sulphuric	.05
Ammonia, aqua	.08
Ammonium carbonate	.15
Ammonium chloride	.11
Ammonium hydrosulphuret	.35
Ammonium sulphate	.07
Arsenic, white	.10
Copper sulphate	.10
Cobalt Sulphate	.50
Iron perchloride	.20
Lead acetate	.16
Nickel ammonium sulphate	.10
Nickel carbonate	.50
Nickel sulphate	.17
Potassium carbonate	.40
Potassium sulphide	.30
Silver chloride (per oz.)	.65
Silver nitrate (per oz.)	.45
Sodium bisulphite	.10
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.35
Sodium hydrate	.04
Sodium hyposulphite (per 100 lbs.)	3.00
Sodium phosphate	.14
Tin chloride	.45
Zinc chloride	.20
Zinc sulphate	.08

Prices Per Lb. Unless Otherwise Stated.

ANODES.

Nickel	.47 to .52
Cobalt	1.75 to 2.00
Copper	.22 to .25
Tin	.45 to .50
Silver	.55 to .60
Zinc	.22 to .25

Prices Per Lb.

PLATING SUPPLIES.

Polishing wheels, felt	1.50 to 1.75
Polishing wheels, bullneck	.80
Emery in kegs	4½ to .06
Pumice, ground	.05
Emery glue	.15 to .20
Tripoli composition	.04 to .06
Crocus composition	.04 to .06
Emery composition	.05 to .07
Rouge, silver	.25 to .50
Rouge, nickel and brass	.15 to .25

Prices Per Lb.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., October 4, 1915.—The news from the front is having a cheerful effect upon the general market. The production of shells is still holding the attention of a large number of our manufacturers, and is progressing at a satisfactory rate. The feeling of uncertainty of producing a shell that will stand a rigid inspection has now passed, and the output of 3.3 and 4.5 shells in both shrapnel and high explosive form has reached the stage, that no future shortage in this connection need be looked for. The attention of many of our shell makers is now directed to the prospects of a heavier type of projectile being required, and in some cases preparations are already in progress for the manufacture of shells up to nine and twelve inches in diameter.

The prospect of field guns being built by Canadian concerns in the near future, has developed several inquiries relative to machine tool requirements; no definite action has as yet been taken in the matter.

Steel.

The steel mills are operating practically to capacity on war stock, and orders are still coming in for rounds, in many cases up to 6 inches diameter. This condition of affairs is likely to be maintained for many months to come.

Pig Iron.

Pig iron is little changed from previous weeks, quotations are generally holding firm, prices on "Victoria" showing an advance of 50c per hundred.

Metals.

Little change is noted in metal quotations, the only metal affected being aluminum, which shows an increase from 50 to 52 cents. The market in tin is dull, a few inquiries being made for October and November delivery. There is, however, little to stimulate buying, and large unsold stocks have a tendency towards a somewhat pessimistic feeling.

Lead remains quiet, expectations of an advance have not been realized. Prices are holding firm.

Spelter remains steady with inquiries for future delivery a little more pronounced.

Antimony is quiet but firm, while aluminum shows a little stronger tone.

Machine Tools and Supplies.

Machine tools are still in strong demand, and with the prospect of the manufacture of larger and heavier type shells in the near future, the enterprise and capacity of the manufacturers is sure to be taxed to the utmost limit to procure reasonable delivery.

Machine shop supplies as may be expected are being used in larger quantities each succeeding week. Quotations on high speed steel are quite indefinite due to the fact that makers have withdrawn price lists, owing to the difficulty in securing the raw material.

Old Material.

The market in scrap metals is fairly brisk, crucible copper has advanced $1.00 per hundred, wire shows a slight increase, while No. 1 wrought iron and heavy melting steel show an advance of $1.00 per hundred. Heavy lead is up to $4.50.

Toronto, Ont., Oct. 5.—An encouraging feature to be noted is the continued increase in our export trade, although this has not as yet done much to improve domestic business. The improvement in the steel trade, referred to later in these columns, is a good indication of the development that is taking place. While the principal development has been in the export trade, it will obviously be of the greatest benefit to the country generally, and will in due course help to stimulate internal trade. There has been for some time, and there still is, a decided tendency to economize in all directions, and consequently development will be restricted until conditions are on a more stable basis, which can hardly be expected until the war is over.

It is, however, satisfactory to note that the Dominion revenues for September promise to be even greater than anticipated. In the Customs revenue alone there is an increase of over two million dollars for the month of September over the corresponding month last year, and an increase of about $1,750,000 for the first half of the present fiscal year. All indications point to a gradual improvement in domestic trade, due largely to war business of various kinds and, of course, to the excellent crops.

The output of shells is rapidly increasing. It is estimated that Canadian plants are producing one million shells per month, and that of this number 17,000 are being turned into fixed ammunition per day. It is announced that the Dominion Steel Corporation have practically completed arrangements for a large order for shell. The Canadian Car & Foundry Co. are making arrangements for sub-letting the last Russian shell contract to American and Canadian firms.

Steel Market

That the steel trade in Canada is now in a prosperous condition is proved by the reports of the Dominion Steel Corporation and the Nova Scotia Steel Co. issued recently. As regards the first mentioned concern, the indebtedness to the bank is being rapidly wiped out by means of profits made principally in export business. It is stated that heavy orders have been received for bars, billets, wire and nails, and that contracts for T.N.T. have proved exceptionally profitable. The coal trade has also been the best in the history of the company.

With regard to the Nova Scotia Steel & Coal Co., the annual statement was considered most satisfactory. The output of shells for September this year was the largest for any month since the manufacture of munitions began, being over 40 per cent. greater than for August. It was reported that the orders on hand would keep the plant at the present high rate of production for at least six months, and that negotiations for further orders were in progress. The Eastern Car Co., a subsidiary of the Nova Scotia Steel Co., is doing well. The first consignment of 250 fifty-ton box cars for the Russian Government has been shipped and will go via the Panama Canal and Vladivostock. The complete order calls for two thousand cars, all of the fifty-ton capacity. The Algoma Steel Co. has booked an order for 17,000 tons of steel rails from the Pere Marquette Railway.

The steel plants continue working to capacity on bars and forgings for shells, there being practically no limit to the demand. The merchant bar business has improved to some extent, but the demand for structural shapes is still very light. Prices on steel products generally are very firm and may go higher. The high-speed tool steel situation is unchanged, and prices will no doubt advance further. The most serious aspect of the situation, however, is the difficulty of obtaining supplies in sufficient quantity, as an enormous amount of high-speed steel is now being used. Prices of galvanized sheets are firmer and have a higher tendency, owing to the recent strength of spelter.

The steel trade in the States is very active, and the demand for steel products of all kinds is increasing. The mills are full up with business, and the export demand for steel rounds for shell, barb wire and other steel products is enormously heavy. There is a great scarcity of Bessemer and open-hearth billets, and prices are very firm, forging billets having advanced to $33 f.o.b. Pittsburgh. Steel hoops are now being quoted at 1.50c Pittsburgh. Prices on

bars, plates and shapes are very firm, with an upward tendency.

Pig Iron

The situation, generally speaking, is unchanged. There is a good demand for steel making pig iron, but foundries are quiet. It is reported that some pig iron is being exported to France. There are no price changes to note this week.

Scrap Metal

The scrap metal market is stronger, particularly for heavy melting steel, copper, brass and zinc scrap. Copper and brass scrap have advanced ½c to 1c per pound; zinc ½c per pound, and heavy melting steel $1 per ton. Wrought iron scrap is now being quoted at $9, and machinery cast iron at $11 per ton. Heavy lead is easier at 4½c per pound.

Machine Tools

The situation in the machine tool trade is practically the same as has prevailed for some weeks. Machine tool builders are working to capacity to fill orders on their books, but deliveries are still very backward. Comparatively few orders for new tools have been placed recently with local machinery houses, although a few of the larger firms making shells are buying single machines, in some cases second-hand tools. In the States there is a big demand for tools, and factory extensions are being held up owing to the difficulty in obtaining prompt delivery. In addition to the domestic demand, it is stated that English, French and Russian buyers are picking up all the machines they can find.

Supplies

The brisk demand for machine shop supplies continues, and prices are holding very firm. Prices of high-speed twist drills have practically been withdrawn, and are only being quoted subject to immediate acceptance. This is due, of course, to the scarcity and price of high-speed steel. Carbon drills have not as yet been affected, although there is a possibility of slightly higher prices being put in force.

Half-and-half solder has declined ½c and is now quoted at 23½c per pound. This is due to weakness in the tin market. Linseed oil has advanced 7c per gallon and is now quoted at 72c for raw and 75c for boiled oil. Turpentine is unchanged at 64c per gallon, but there is a possibility of higher prices.

Metals

The successful termination of the Anglo-French loan negotiations in New York and the rise in sterling exchange to a more normal basis is expected to have a beneficial effect on the metal market. There has been, however, up to the present, no marked improvement, and with the exception of tin and copper there have been no price changes of any particular importance. There has been increased activity in the copper market recently and prices are a little higher. Tin on the other hand has declined, due to weakness in the London market. The spelter situation is unchanged and the market steady. The lead market is firm and the price stationary. The antimony market is featureless, but there is a continued scarcity of aluminum, and quotations have a higher tendency. There is no change in the general situation locally and a brisk demand is reported for metals for munitions, ordinary business being only fair.

Tin.—The market is very dull and consumers are showing comparatively little interest in either spot tin or futures. An over-supply of spot metal is also depressing the market. Tin has declined 1c locally and is being quoted at 38c per pound.

Copper.—The market is firm and higher, due to increased demand. It is believed that stocks are accumulating in the States notwithstanding the heavy consumption; production having reached a record mark. Copper has advanced ½c and is quoted here at 19½c per pound.

Spelter.—The market has a strong tone, due to a scarcity of metal for prompt shipment. The London market is higher, but New York is unchanged and quiet. Local quotations are unchanged at 18c per pound.

Lead.—The market is quiet and featureless. Quotations are unchanged at 6¼c per pound.

Antimony.—The market is quiet and unchanged. On the London market little interest is being taken in antimony, as it is controlled by the Government. Local quotations are unchanged at 35c per pound.

Aluminum.—Supplies of this metal are very difficult to obtain for immediate delivery, except in small lots. Quotations are unchanged and nominal at 55c per pound.

CANADIAN GOVERNMENT PURCHASING COMMISSION

The following gentlemen constitute the Commission appointed to make all purchases under the Dominion $100,000,000 war appropriation:—George F. Galt, Winnipeg; Hormidas Laporte, Montreal; A. E. Kemp, Toronto. Thomas Hilliard is secretary, and the commission headquarters are at Ottawa.

ALLIES PURCHASING AGENTS

The Trade and Commerce Department, Ottawa, has published the following list of purchasing agents for military purposes for the allied Governments:

International Purchasing Commission, India House, Kingsway, London, Eng.

French.—Hudson Bay Co., 56 McGill Street, Montreal; Captain Lafoulloux, Hotel Brevort, New York; Direction de l'Intendence Ministere de la Guerre, Bordeaux, France; M. De la Chaume, 28 Broadway, Westminster, London.

Russian.—Messrs. S. Ruperti and Alexsieff, care Military Attache, Russian Embassy, Washington, D.C.

BIG HYDRO PLANS GO TO GOVERNMENT

PLANS for power development that will make the Hydro-Electric system of Ontario independent of all private developments and provide a supply sufficient not only for the next few years, but for many years to come, have been given final approval by the Hydro-Electric Commission and sent on to the Government.

As outlined by Sir Adam Beck at London several months ago upon the opening of the first Hydro radial in the province, the plans call for an initial development of 100,000 horse-power by utilizing the maximum head of power on the Niagara River, now undeveloped. The plants, it is understood, outline a possible supply from this source of 250,000 horse-power and cover as well developments possible from the utilization of the Welland Canal spillways, which will add as much more to the power supply of Ontario.

The construction of a great development plant in the Niagara district has become an urgent necessity by the rapid growth of the cheap power system in Ontario. Sir Adam Beck and his colleagues on the commission, Hon. I. B. Lucas and W. K. McNaught, C.M.G., are facing the end of their present sources of supply. The 100,000 horse-power supply contracted for with private interests at Niagara Falls will soon be exhausted by the increasing demands of the municipalities, which even the big increase in the supply from new plants here and there in the province will not meet. With the advent of Hydro radials on an important scale, the present supply will fall far short, and when that time arrives the commission must be in a position to furnish practically unlimited power.

The commission has received word that the Council of Gravenhurst has passed a by-law approving of a contract with the commission for the sale of the South Falls power plant, owned by the town. This plant is now producing but 500 horse-power, but the commission's engineers have estimated that the output can be immediately enlarged to 1,500, with a maximum horse-power without storage of 2,500 and storage of 4,000. The surplus power will be used to supply municipalities in the surrounding district, which have been pressing the commission for power. The Gravenhurst by-law will be submitted to the ratepayers on October 2.

THE CHEMICAL ENGINEER

IN the modern organization there is room for the research chemist of high and wide attainments, for the scientifically trained engineer, also of wide attainments, and for a type of professionally trained man who is the natural medium of interchange between these two specialists. This intermediary is the chemical engineer. He must be a man of special aptitudes, inasmuch as he must have grasped the chemist's point of view as well of the engineer's. The chemist thinks and works in terms of atoms and molecules and the laws which govern their combination. The engineer thinks of matter in masses which can be moulded to his will by the craftsman, or of mechanical or electrical energy which can be generated, controlled, and measured by machinery. The chemist is the master and director of his own operations, which he can, for the most part, carry out with his own hands. The engineer loses his direct hold on his operations whenever his ideas have been fully committed to paper in the drawing office. It is his special function to organize the labors of many workers. A certain number of men are able to enter fully into the spirit which actuates both types of expert, the chemist and the engineer; they can resist the particular exclusiveness of each, while giving to each its due weight. These are the naturally gifted chemical engineers who in one sense are "born, not made." In our colleges and universities the best that we can do for men of this gifted type is to give them the best possible opportunities for an all-round development of their powers. Dr. G. T. Bellby on "Chemical Engineering."

TO PREVENT accidents we must thoroughly understand their causes. Every danger point in every machine and in every process must be located and definitely grappled with. It is important to report accidents, but it takes less time to prevent them. Two minutes' work or care will often prevent an accident that would lose a man days from work.

CANADIAN COMMERCIAL INTELLIGENCE SERVICE

The Department of Trade and Commerce invites correspondence from Canadian exporters or importers upon all trade matters. Canadian Trade Comissioners and Commercial Agents should be kept supplied with catalogues, price lists, discount rates, etc., and the names and addresses of trade representatives by Canadian exporters. Catalogues should state whether prices are at factory point, f.o.b. at port of shipment, or, which is preferable, c.i.f. at foreign port.

CANADIAN TRADE COMMISSIONERS.

Argentine Republic.

H. R. Poussette, 278 Balcarce, Buenos Aires. Cable Address, Canadian.

Australasia.

D. H. Ross, Stock Exchange Building, Melbourne, Cable address, Canadian.

British West Indies.

E. H. S. Flood, Bridgetown, Barbadoes, agent also for the Bermudas and British Guiana. Cable address, Canadian.

China.

J. W. Ross, 6 Kiukiang Road, Shanghai. Cable Address Cancoma.

Cuba.

Acting Trade Commissioner, Lonja del Comercio, Apartado 1290, Havana. Cable address, Cantracom.

France.

Phillipe Roy, Commissioner General, 17 and 19 Boulevard des Capucines, Paris. Cable address, Stadacona

Japan.

G. B. Johnson, P.O. Box 109, Yokohama. Cable Address, Canadian.

Holland.

J. T. Lithgow, Zuidblaak, 26, Rotterdam. Cable address, Watermill.

Newfoundland.

W. B. Nicholson, Bank of Montreal Building, Water Street, St. John's. Cable address, Canadian.

New Zealand.

W. A. Beddoe, Union Buildings, Customs Street, Auckland. Cable address, Canadian.

South Africa.

W. J. Egan, Norwich Union Buildings, Cape Town. Cable address, Cantracom.

United Kingdom.

E. de B. Arnaud, Sun Building, Clare Street, Bristol. Cable address, Canadian.

J. E. Ray, Central House, Birmingham. Cable address, Canadian.

Acting Trade Commissioner. North British Building East Parade, Leeds. Cable address, Canadian.

F. A. C. Bickerdike, Canada Chambers, 36 Spring Gardens, Manchester. Cable address, Cantracom.

Fred. Dane, 87 Union Street, Glasgow, Scotland. Cable address, Cantracom.

Harrison Watson, 73 Basinghall Street, London, E.C., England. Cable address, Sleighing, London.

CANADIAN COMMERCIAL AGENTS.

British West Indies.

Edgar Tripp, Port of Spain, Trinidad. Cable address, Canadian.

R. H. Curry, Nassau, Bahamas.

Colombia.

A. E. Beckwith, c-o Tracey Hmos, Medellin, Colombia. Cables to Marmato, Colombia. Cable address, Canadian.

Norway and Denmark.

C. E. Sontum, Grubbeged No. 4, Christiania, Norway. Cable address, Sontums.

South Africa.

D. M. McKibbin, Parker, Wood & Co., Buildings, P.O. Box 559, Johannesburg.

E. J. Wilkinson, Durban, 41 St. Andrew's Buildings, Durban, Natal.

CANADIAN HIGH COMMISSIONER'S OFFICE.

United Kingdom.

W. L. Griffith, Secretary, 17 Victoria Street, London, S.W., England.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Montreal, Que.—It is reported that Gustave Pollien is contemplating the erection of a plant for the manufacture of aeroplanes, etc.

Windsor, Ont.—The Kelsey Wheel Co. will make an extension to their factory at a cost of $10,000. Wells & Gray, of Windsor, are the general contractors.

Walkerville, Ont.—The Canadian Detroit Lubricator Co. will make an extension to their factory. Wells & Gray, Windsor, Ont., are the general contractors.

Collingwood, Ont.—The Imperial Steel & Wire Co. will start operations at their plant early in October. Some delay has been experienced in connection with the contracts.

Gravenhurst, Ont.—The Muskoka Lakes Corporation is contemplating installing a number of small steam pumps at various points for fire protection. W. F. Wasley, of the Muskoka Navigation Co., is manager.

Fort William, Ont.—The Fort William Coal Docks Co., contemplate making an extension to their plant on the Mission River, estimated to cost $200,000. Included in the proposed addition will be a new hoist of a larger size than those now in use on the docks.

Toronto, Ont.—A scheme to provide a water supply for the southern portion of York Township was outlined in the report of Engineer Hugh Gall, submitted to the York Township Council at a special meeting held on September 30. The project as embodied in the report makes provision for all that district lying between the city limits and Eglinton Avenue, a distance of one and one-half miles. It is proposed to lay 12-in. and 6-in. cast iron pipe. The probable cost as estimated by the engineer is $750,000.

New Liskeard, Ont.—Another large pulp and paper mill is to be built in Timiskaming. Sutcliffe & Neelands, engineers, of Liskeard, have been advised to hold themselves in readiness to proceed with work discontinued when war broke out. The location of the proposed mill is some 30 miles west of Cochrane. Three miles of railway are necessary to connect with the Transcontinental Road. It is estimated $2,000,000 will be expended in the construction of this new pulp mill, and American capital is being used.

Electrical

Chatsworth, Ont.—A by-law will be voted on to raise $4,000 for a hydro-electric system.

London, Ont.—The City Council will purchase electrical equipment for the Hydro sub-station.

St. Marys, Ont.—Work is to commence on the new Hydro line from St. Marys to Exeter. The main power line will run from St. Marys to Exeter, passing through Woodham and Kirkton.

Municipal

Walkerville, Ont.—The railway bylaw will be voted on by the ratepayers on October 16.

Dundas, Ont.—The town council passed a by-law to spend $25,000 on the extension of the waterworks system.

East Angus, Que.—It is proposed to spend $5,000 on extensions to the waterworks system.

Thetford Mines, Que.—A waterworks system will be installed at a cost of $12,000.

Blenheim, Ont.—The town council contemplate installing an ornamental lighting system.

Brigden, Ont.—The bylaw to authorize the extension to the lighting plant has been defeated.

Goderich, Ont.—The town council are considering the installing of an electric light and power plant.

East Angus, Que.—The town will make extensions to its waterworks plant to cost $5,000. R. C. Cowling is clerk.

St. Hyacinthe, Que.—A by-law has been carried providing for the installation of a complete gravity filter system, with a capacity of 4,000,000 gallons per day. Estimated cost, $75,000.

Woodstock, Ont.—The ratepayers are asking the council to compel the Woodstock Gas Light Co. to supply purified gas. It is suggested that purifiers be installed by the company.

Sarnia, Ont.—A by-law will be voted on in the near future to sanction the purchase of the local electric light plant by the city.

Montreal, Que.—The city has completed a modern street lighting system through the business portions of the city, on St. Catherine and Bleury, two of the main retail thoroughfares. The turning on of the current for this system will give Montreal its first street illumination of a modern character.

Brockville, Ont.—The Water and Light Commission has decided to call new tenders for the filtration plant, according to revised plans and specifications prepared by the town engineer. One set of tenders have already been received but certain alterations have been made in the plans to suit local conditions.

Port Moody, B.C.—If the electors of Port Moody endorse a bylaw to be voted upon on Oct. 7, the city will become the home of an extensive steel works and rolling mills to be erected there by the Port Moody Steel Works Ltd. The bylaw is one to authorize the city council to make an agreement with the company guaranteeing its debentures to the amount of $100,000.

Winnipeg, Man.—Seven tenders for electric mains, switchboards and circuit breakers for the power house at the new law courts, were opened by Hon. T. H. Johnson, minister of public works, on September 29. The tenders were as follows: The Schumacker, Gray Co., $6,950; Star Electric, $7,000; Electric Motor Sales & Repair Co., $7,985; Goold Engineering and Supply Co., $6,490; The Dominion Equipment and Supply Co., $6,880; Robert McCrea, $6,537.50; McDonald & Wilson Lighting Co., $7,077.

General Industrial

Montreal, Que.—Pilkington Bros. have received a permit for the erection of a new factory.

Chatham, Ont.—The William Rennie Co., Toronto, are building a warehouse and elevator, estimated to cost $20,000.

Petrolia, Ont. — The Marine City Sugar Co. is contemplating establishing a plant, which will cost about $800,000. E. Hyatt, Petrolia, is a stockholder.

St. John, N.B.—Daley & Carvell have purchased a site of 20 acres at Washademoak, N.B., and will build a factory for the manufacture of axes, etc.

Hamilton, Ont.—The Mercury Mills Co. will build a factory here, to cost approximately $250,000. It is expected that construction work will begin shortly.

Medicine Hat, Alta.—W. E. Clarke proposes to establish a plant here for making clay products. A by-law will probably be voted on by the ratepayers on October 25, to ratify an agreement concluded by the City Council.

Ryerson, Sask.—The Saskatchewan Co-operative Elevator Co.'s elevator at this place was destroyed by fire on Sept. 21. The loss is estimated at $8,500, which is fully covered by insurance. The elevator will be rebuilt.

Winnipeg, Man.—Alfred W. Lawson, of New York City, a prominent manufacturer of aeroplanes, etc., has been in communication with Industrial Commissioner Roland with regard to establishing a factory here for making aeroplanes.

Tenders

Ottawa, Ont.—Tenders for examining warehouse fittings, Fort William, Ont., will be received until Thursday, October 14, 1915. Plans and specifications may be seen on application to J. C. Stinson, clerk of works, Fort William, Ont.; Thos. A. Hastings, clerks of works, Postal Station "F," Toronto, Ont., and at the Department of Public Works, Ottawa.

Ottawa, Ont.—Tenders for public building fittings, Three Rivers, P.Q., will be received until Wednesday, October 13, 1915. Plans and specification may be seen on application to Chas. Lafond, architect, Three Rivers, P.Q.; to R. L. Deschamps, overseer, Montreal Central Post Office, and at the Department of Public Works, Ottawa.

Ottawa, Ont.—Under the direction of the Honorable the Minister of Militia and Defence, certain old stores, consisting of leather, 2,700 lbs.; leather, buff, 335 lbs.; wrought iron, 4,200 lbs.; scrap steel, 116 lbs., and other stores, comprising canvas, rope, rubber, tarpaulins, mattresses, etc., are for sale by public tender until October 15. These stores may be seen on application to the senior ordnance officer, Old Fort, Toronto, daily, between the hours of 2 p.m. and 6 p.m., Saturdays and Sundays excepted. Eugene Fiset, Deputy Minister, Department of Militia and Defence, Ottawa.

Toronto, Ont.—Tenders will be received, addressed to the chairman, Board of Control, up to Tuesday, October 12, 1915, for the construction and delivery of 36-inch stop valves, valve operating mechanism and special castings, for main pumping station. Specifications and forms of tender may be obtained at the Works Department, Room 12, City Hall.

Ottawa, Ont.—Tenders will be received up to Tuesday, October the 19th, for the undermentioned items for delivery to H.M.C. Dockyards at Halifax, N.S., and Esquimalt, B.C.: Brass bars, antimony, iron firebar, brass sheets, aluminum, pig iron, brass tubes, steel angles, iron angles, copper sheet, steel boltstaves, iron boltstaves, copper tubes, steel plates, iron sheets, zinc plates, steel sheets, India rubber, lead, milled steel for tools, sheet packing, or sheet, etc. Forms of tender and all information may be obtained by application to the undersigned, or to the Naval Store Officer at H.M.C. Dockyard, Halifax, N.S., or Esquimalt, B.C. Applicants for forms are requested to state definitely the item or items on which they desire to tender. G. J. Desbarats, Deputy Minister of the Naval Service.

Building Notes

St. John, N.B.—It is reported that large extensions will be made to the warehouses at the Sand Point docks here.

Toronto, Ont.—The erection of fire stations at Earlscourt and Wychwood, is contemplated. Plans have been prepared and sites purchased.

Toronto, Ont.—The city architect has issued a building permit to the Board of Education for the erection of a three-storey brick addition, costing $51,500, to the North Toronto school on Eglington avenue, near Brownlow avenue.

Toronto, Ont.—The Toronto Furniture Co. have applied to the City Architect's Department for permission to build a $12,000 factory on Dufferin street near Liberty street. This will be used for the purpose of making boxes for the shipment of shrapnel shells.

Toronto, Ont.—The Board of Control has granted to the Dominion Government a permit for the erection of a temporary post office at the south-east corner of Front and Bay Streets. It will be 100 by 200 feet, clad with steel, two storeys high, with flat roof.

Preston, Ont.—The Hydro-Electric Commission has just completed arrangements for the erection of six transformer station storehouses in Guelph, Preston, Berlin, St. Mary's, Woodstock, and Cooksville. The buildings will be 36 by 60 feet, and will be of metal construction throughout.

Toronto, Ont.—The Board of Education proposes to build a large new school on Gledhill avenue, East Toronto, at a cost of $55,400. An application has been made for a permit for this work. The Architect's Department has issued a permit to the Board for the erection of a three-storey brick school on Eglington avenue, near Brownlow avenue. The structure will cost about $51,500.

New Incorporations

The France & Canada Steamship Co. has been incorporated at Ottawa, with a capital of $1,000,000, to operate a line of steamers between Canada and France. The head office will be in Montreal, Que.

The Standard Toys, Ltd. has been incorporated at Toronto, with a capital of $40,000, to carry on the business of manufacturing toys, etc., at Toronto. Incorporators, John Anthony Chantler and Ernest Walter Chantler, of Toronto.

The Franco-Canadian Chemical Co. has been incorporated at Toronto, with a capital of $1,000,000, to manufacture drugs and chemicals, at Toronto, Ont. Incorporators, Robt. Alexander Stephen and Adam McGowan Cook, of Toronto, Ont.

The Dominion Brake Shoe & Foundry Co. has been incorporated at Ottawa, with a capital of $200,000, to manufacture all kinds of brake shoes at St. Thomas, Ont. Incorporators, James Stellar Lovell and William Bain, of Toronto, Ont.

The Dome Consolidated Mines, Ltd. has been incorporated at Toronto, with a capital of $3,000,000 to acquire and develop mineral lands and deposits. The head office of the company will be at Toronto. Incorporators, Charles Henry Manaton and Arthur Hodgetts, of Toronto, Ont.

The Montreal Engine Packing Co. has been incorporated at Ottawa, with a capital of $20,000, to take over the business carried on under the name of Montreal Engine Packing Co. at Montreal. Incorporators, Edgar Alexander Wright and Gordon Balfour Kingan, of Montreal.

The Canadian Duplex Steam Trap Co. has been incorporated at Ottawa, with a capital of $40,000, to manufacture steam traps and other appliances, at Walkerville, Ont. Incorporators, Joseph Hector Mailhot and Thomas George Rakestraw, of Detroit, Mich., and Harry Owens Kerr, of Walkerville, Ont.

Manufacturing Tin Powder Cups for Shrapnel Shells

Staff Article

The various component parts which enter into the construction of shrapnel shells call for work of considerable variety. While powder cups are simple in form, the exacting requirements demand the use of accurate methods and every care in workmanship and material.

TO secure the proper results from the discharge of a shrapnel shell the charge of bullets and resin contained in the shell must be discharged when at a certain distance from the desired target. To accomplish this object, a time fuse is ignited by percussion at the time the shell is discharged from the gun. During the period of flight this fuse burns through channels previously set by adjustment of the time fuse, which at the appointed time connects with a quantity of explosive powder at the base of the shell.

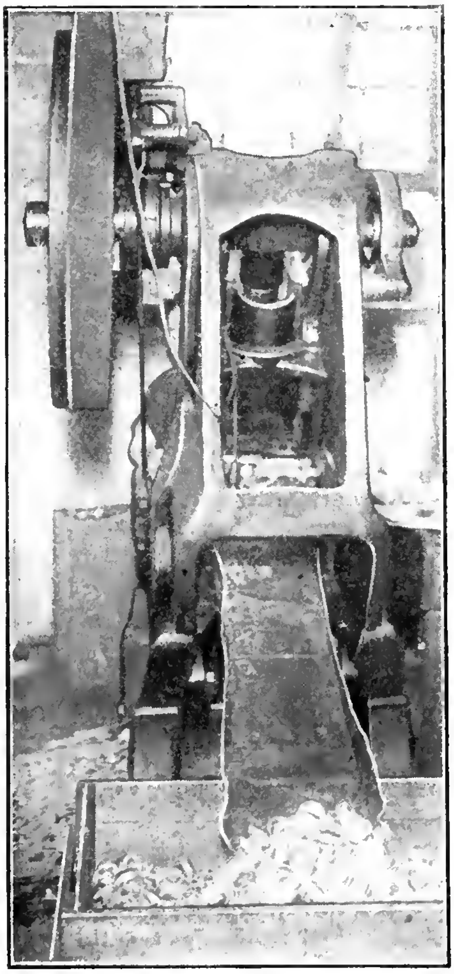


FIG. 1. FORMING POWDER CUPS ON POWER PRESS.

In the British shrapnel shell this explosive charge is contained in a small tin plate cup, which fits the chamber prepared in the base of the shell. Directly above this powder cup and separating it from the charge of bullets and resin is a steel diaphragm, which when discharged forces the bullets and resin out through the nose of the shell in the form of a spray, at a velocity of from 200 to 300 ft. per second in excess of the velocity of the shell at the time of shrapnel discharge.

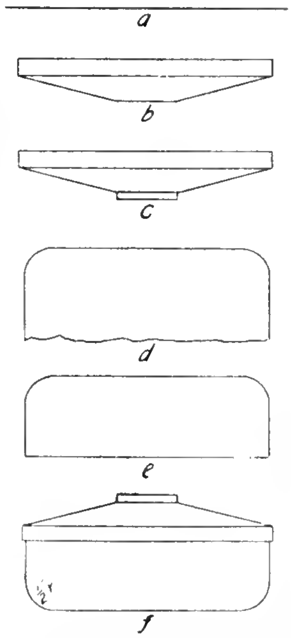


FIG. 4. POWDER CUP FORMING PROCESSES.

The production of these tin powder cups forms one of the many problems that the manufacturers of this country have met and overcome.

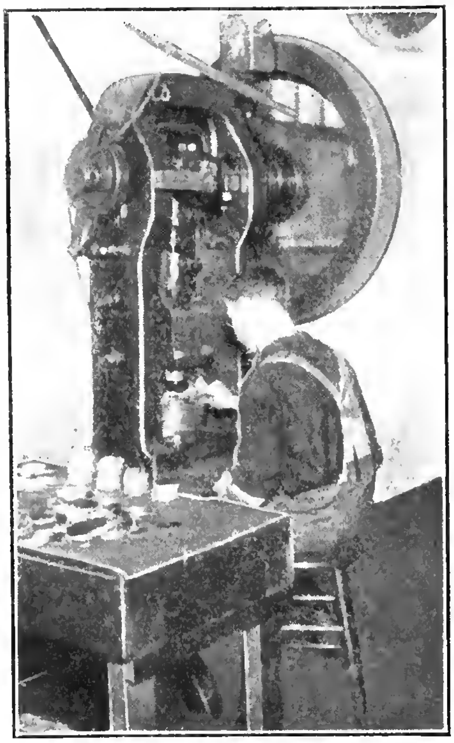


FIG. 5. FORMING COVERS FOR CUPS

Forming the Cup.

The various operations for the completion of this necessary part of the shrapnel shell is here given.

The first operation on the base of the cup is performed in a combination die

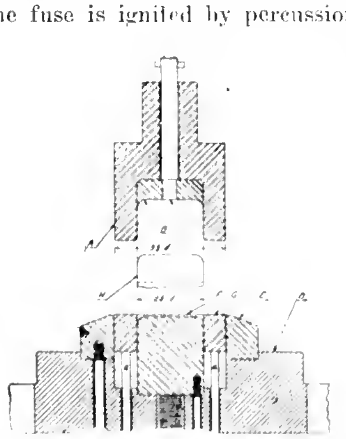


FIG. 3. COMBINATION DIE FOR FORMING POWDER CUPS.

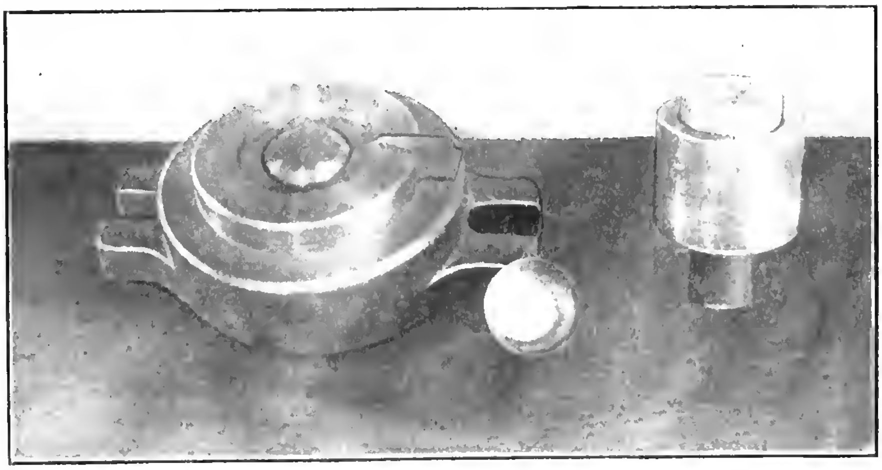


FIG. 2. FIRST OPERATION TOOLS FOR BASE OF POWDER CUP

on the press, shown in Fig. 1. A closer view of this die is seen in Fig. 2, with a view of the cup as it comes from the die. The general construction of the die is shown in Fig. 3. The punch A is made of cast steel, recessed and bored to receive the knock-out piece B and ejector bolt C, which is riveted securely to the knock-out.

The joint between the base and the cover must be firmly soldered. This is done by placing the cup in the jig shown in Fig. 7, and revolving while the solder is being applied. The casting A is secured to the bench B. The stem of the piece C is turned a free running fit in the hole in the casting and pivoted on a sharp point shown, allowing it to turn

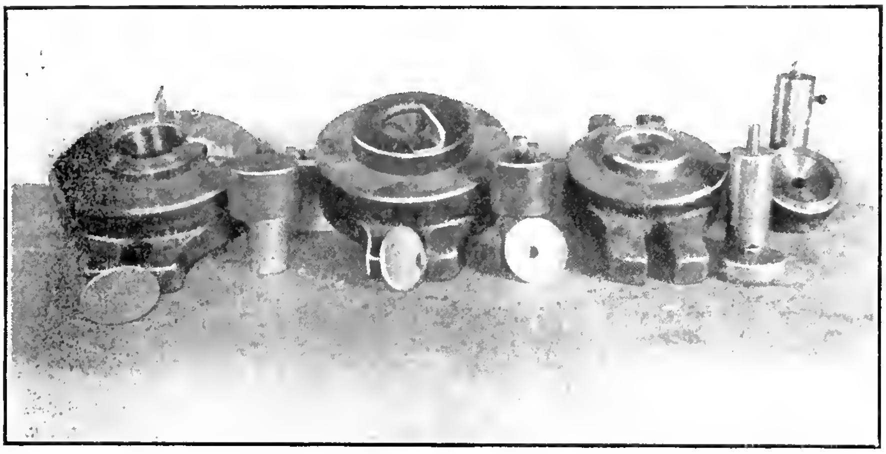


FIG. 6. CLOSE VIEW OF TOOLS FOR PRODUCING POWDER CUP COVERS.

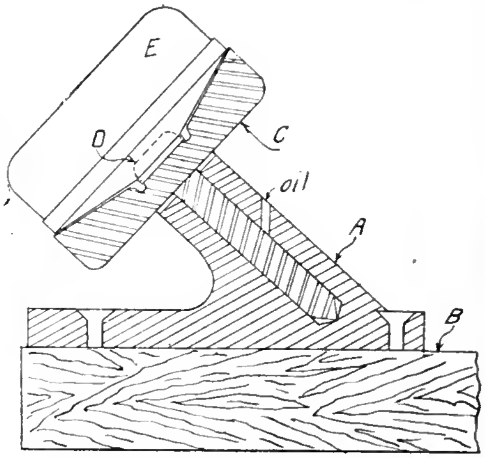


FIG. 7. POWDER CUP SOLDERING JIG

In the die bed D is secured the cutting ring E. The forming post F is placed in a counterbore in the centre of the die bed and secured by means of three screws. The draw ring G is supported by means of four 3/8-in. pins (a) (a). These pins in turn are supported by a plate encircling a rod screwed into the tapped hole in the base of the die. The pressure is derived from the use of a cylinder of rubber between two plates and about the projecting rod.

The piece H is a sketch of the cup as it comes from the die, also shown at (d) Fig. 4. These cups are then placed in a small chuck on a speed lathe and trimmed, as shown at (e) Fig. 4.

Making the Cover and Soldering the Cup

The first operation on the cover is blanking the disc, which is 2 19-32 in. in diameter and .022 in. thick.

The second operation shown at (b) Fig. 4 is shaping the piece, which is performed in the press operation seen in Fig. 5. The next operation is piercing the hole in the centre, followed by the throwing up of the flange, as shown at (c) Fig. 4. Following this operation, the two pieces are placed together in a press, Fig. 8, and firmly forced to their final position, as shown at (f) Fig. 4.

freely. A pilot D is turned on the piece C for centering and holding the cup E while being soldered.

THE MUNITION SITUATION

A REORGANIZATION of the Canadian Shell Committee, under General Bertram, and further large orders for the heavier types of shells, with the possibility of orders for the manufacture of heavy guns for the British Government in Canada, were amongst the announcements made by D. A. Thomas, the representative of Mr. Lloyd George, Minister of Munitions, in Canada, at a luncheon given in his honor at the Windsor Hotel, Montreal, by the local branch of the Canadian Maufacturers' Association on Friday last. There was a large gathering, representative of many of the large manufacturing concerns in Montreal, and the keenest interest was displayed in Mr. Thomas' utterances.

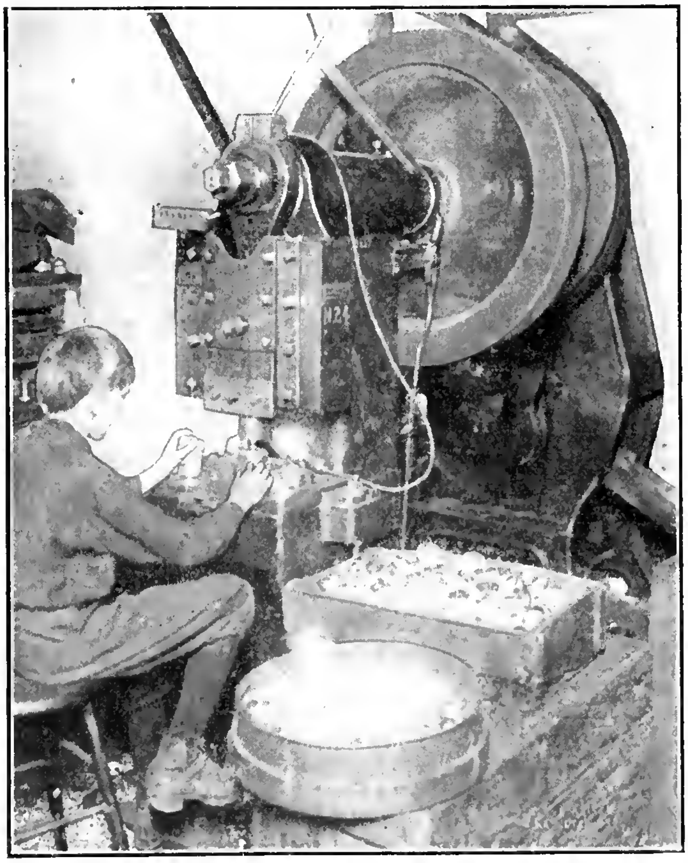


FIG. 8. PRESSING COVER ON POWDER CUP.

For the reorganization of the Shell Committee Mr. Thomas said that with the consent of General Bertram two of Britain's greatest munitions experts, Sir Frederick Donaldson and Mr. Lionel Hichen, were now on their way to aid in this work, and advise with regard to heavy shells and guns.

As to the charge that too many shell orders had gone to to the States and too few to Canada, Mr. Thomas intimated that economy had to be considered, and in the past Canadian manufacturers had been slow in delivery, and higher in price than either the States or England. He, however, stated that the British Government was anxious to give every possible preference to Canada, without sacrificing efficiency, promptness of delivery, or economy of cost.

The British representative also took occasion to reply to the recent interview given by Herbert Holt, criticizing the attitude of the British people in this war. He quoted many instances to prove that the British people were really taking the war seriously.

PRODUCTION METHODS AND DEVICES

A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

SHELL EQUIPMENT IMPROVEMENTS.

By J. H. Moore.

IT is a well known fact that the older and more established a particular process of manufacture may be, there is just that longer a chance to improve on what at the outset appeared to be first class in every respect. The same applies to the manufacture of munitions, and in the following article, the writer will place before the readers, recent improvements in equipment in the manufacture of 18-pounder shrapnel shells.

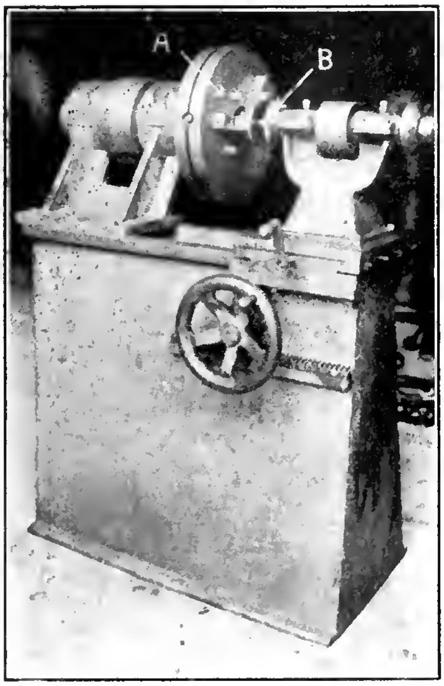


FIG. 1. SPECIAL GRINDER FOR SHELL BASES.

One firm, which has been turning out a considerable quantity of these shells, have found that great trouble is experienced in getting the base of shell just right, both as to size and finish, as the inspectors are very particular of this point. To make sure that all are similar there has been designed and built the machine shown in Fig. 1. It is what might be termed a special purpose grinder, as being built for this work only.

The chuck A is of the three-jaw universal type, allowing the shell to be quickly and accurately adjusted in position. The shell is gripped around the body just above the driving band, leaving the base end exposed. The grinding wheel is mounted between the driving flanges B, the spindle being carried by a grinder head, which is arranged to slide crosswise on the carriage C.

In addition to facing the base end of the shell, the wheel is used to grind the outside diameter of the base, thus necessitating a longitudinal motion by means of hand wheel and rack, as shown on the front of the machine.

In Fig. 2 is shown an improved type of mandril or boring bar used on the inside of the shell. This bar does three operations in turn—namely, the finishing of powder chamber at bottom, the facing of powder chamber shoulder, and the facing of shell to length. Cutter "A" finishes the bottom of chamber. Slot "B" shows where the cutter to finish shoulder goes in; while four slots "C" show where the cutters for facing off to length are placed. The two last cutters have considerable adjustment, as can be clearly seen, and this fact will be keenly appreciated by those who have figured on this type of work. The hole "D" is for internal oil feed, and as bar is hollow, all cutters are well supplied with lubricant.

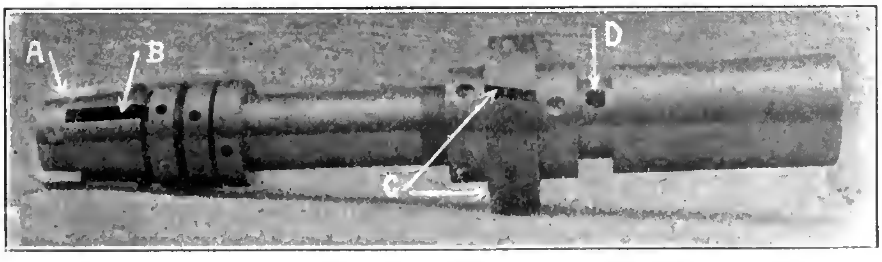


FIG. 2. ADJUSTABLE SHELL ARBOR.

Fig. 3 illustrates a very handy chuck for shrapnel plugs, and one which is not only quick in action, but also extremely accurate. The chuck jaws proper are shown at "A," and are in four parts. A small spring is placed between each jaw for obvious reasons. The body "B" is threaded internally, and screws on a hub on flange "C," which is mounted on the spindle of the machine. The jaws are tapered 18 degs., and this is found to be ample to work satisfactory. To give double driving power to this chuck, a square plug with round shank is placed in hole "D." This square portion of plug engages with square hole in shrapnel plug, and so drives from both this hole and outside diameter, where chuck grasps. Holes E are provided for tightening up body B by means of a pin wrench or bar F.

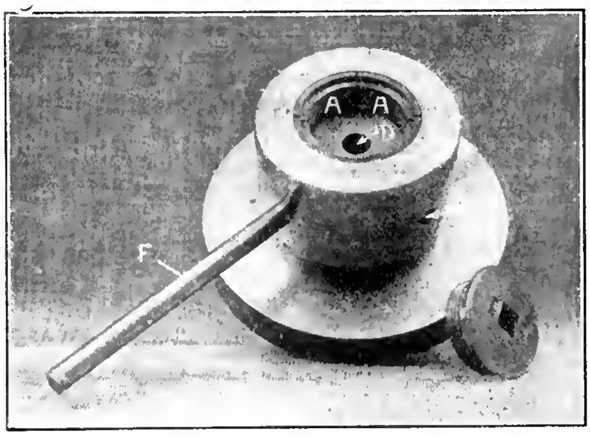


FIG. 3. CHUCK FOR SHELL PLUGS.

AN INTERESTING CURLING FIXTURE

By L. E. Gehman

THE illustrations herewith show a typewriter part and a fixture for curling it to the shape shown. Before curling, the part is cut off and bent with press tools, not shown, as not being of much interest.

To load the fixture shown, the clamp lever A is swung back and the pin B engages with projections C on the sides of the clamp D, thus raising the latter. The clamp is fastened to the body L of the fixture by blocks S and swings on pin R. The blank is placed on the nest E which is machined or profiled so that the blank fits the nest very firmly, the nest being made from a piece of rectangular cold-rolled steel, with rack teeth cut on the under side.

In operation, the rack is engaged by the pinion F which has just a sufficient number of teeth to cause enough movement to perform the operation. The rest of the pinion is left blank to act as a

stop and prevent the operator from disengaging the rack and pinion.

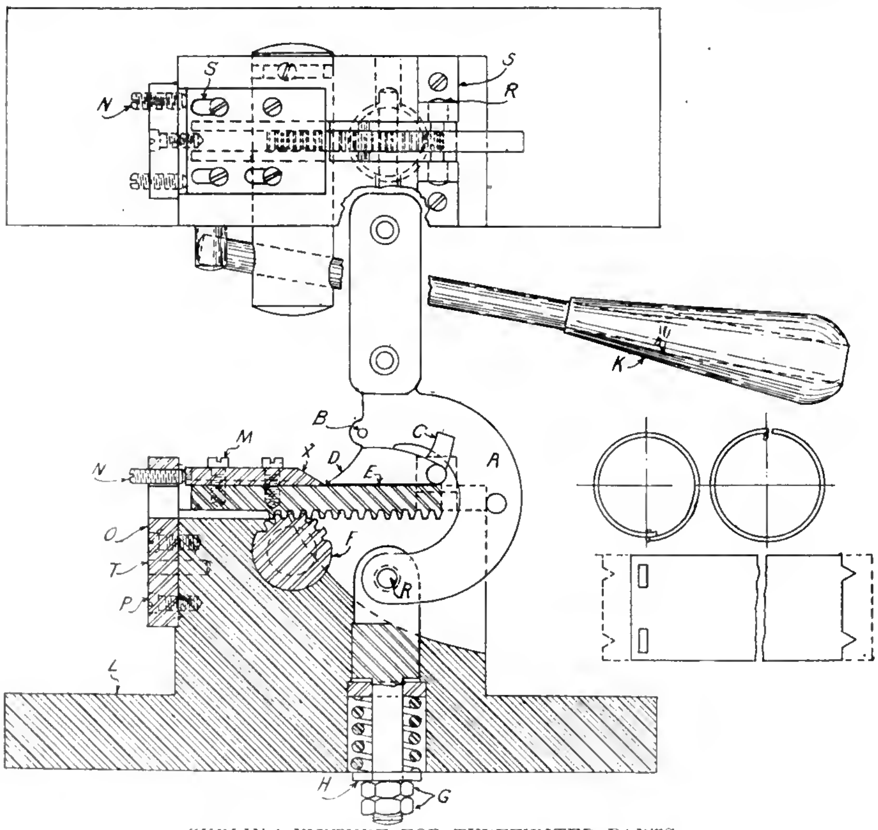
After the blank is placed in the nest E, the clamp lever is drawn toward the operator, forcing the clamp D on to the piece to be curled. The force which the clamp exerts against the piece is regulated by the nuts G and spring H. The latter is adjusted so that there is a good sliding fit between the clamp and the work.

The piece is now ready to curl and the next move is to pull the lever K toward the operator. To this lever is attached the pinion F, which moves the rack and nest forward, and in doing so, the blank is forced against the curling tool which is of tool steel, hardened and ground, and is beveled to an angle of 30 degrees.

The curling tool is fastened to the east iron body L by the screws M, and the holes are elongated as shown to allow for adjustment. The adjustment of the curling tool is made by screws N which are in the bracket O, the latter being fastened to the body by screws P and dowels T.

As the blank is forced against the curling tool, the end of it slides up over the beveled edge, its outer fibres on the side which strikes the curling tool are stretched, and the opposite side contracts, causing the blank to bend up into a circle.

If the blank does not curl enough, the curling tool R is moved nearer to clamp D, and if it curls too much, the tool is moved in the opposite direction until satisfactory adjustment is made.

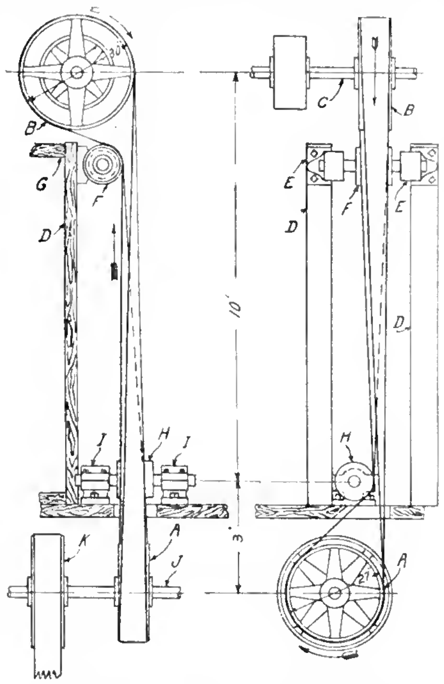


CURLING FIXTURE FOR TYPEWRITER PARTS.

QUARTER TURN DRIVE

By J. H. R.

THE accompanying sketch shows a quarter turn drive employed in the John McDougall Caledonian Iron Works, Montreal, to drive a large planer. While the arrangement may not be original, it may be of some interest to our readers. The position of the planer was such that the counter shaft J would come at right angle to the line shaft.



LAYOUT OF QUARTER-TURN BELT DRIVE

The cut illustrates the method adopted to obtain the desired drive. The counter shaft for the planer is placed so that the lead of the pulley A comes directly below the face of the pulley B, which is on the line shaft C, the latter being located on the gallery above the main floor. The two planks D were erected to support the brackets E which carried the counter shaft on which the idler pulley F is secured. The planks D are kept in position by the brace G. The idler H is secured to the shaft that revlves in the brackets I; these being fastened to the floor as shown. The drive is through an 8-inch double belt, and has given satisfactory service over a considerable period.

STORAGE OF COAL

UNFORTUNATELY, coal does not improve with keeping, but opinions differ considerably as to the extent by which it deteriorates, and as to the means most likely to preserve it economically. Having got some thousands or tens of thousands of tons of coal, preferably at a time when the market price is down, what is the best means of preserving the fuel?

Three methods of storage at least are available. The coal may be piled in stacks, in the open or under cover; or it may be put in bunkers; or it may be placed in tanks which are then filled with water. Bunker storage is limited by considerations of capital cost to relatively small amounts of coal, but is specially convenient for temporary storage, e.g., holding a day or two's supply for the washeries of a colliery or holding fuel on its way—through the bunkers—to a boiler installation. The cost of a tank store is less than that of an equal overground bunker capacity, and is justified in very much larger sizes by the advantages of wet storage.

Ordinary pile storage is the simplest and cheapest system, but it exposes the fuel to "weathering" action, the effect of which is to weaken the coal mechanically, reduce its heating value and introduce a certain risk of spontaneous combustion.

DEMAND FOR NUTS, BOLTS, RIVETS, ETC.

INQUIRIES are being received for nuts and bolts of various sizes. In normal times large quantities are manufactured in the United Kingdom for home use, but the manufacture has been discontinued or curtailed by many factories owing to the utilization of their plant and labor for the making of munitions. In addition, large quantities are annually im-

ported. The United States and Belgium were the main sources of supply before the war, but naturally imports from the latter country have ceased.

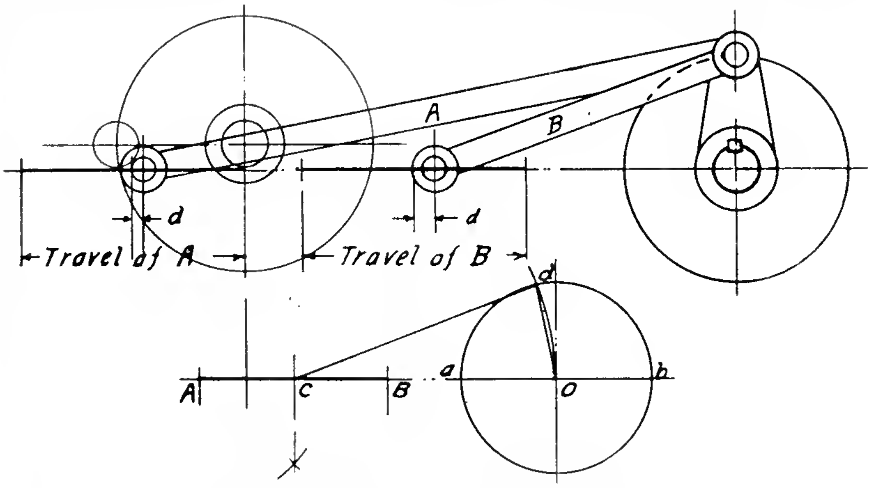
There is also a brisk demand for nails, screws and rivets of all sizes. Manufacturers who are in a position to supply these, or nuts and bolts, should forward a range of samples which will be placed before prospective buyers. In addition, manufacturers are invited to communicate direct with about twenty buyers whose names and addresses may be obtained from the Department of Trade and Commerce, Ottawa.

Questions and Answers

Question — (a)—In a reciprocating engine, is the crosshead and piston in the center of the stroke when the crank pin is midway between the front and dead centers?

(b)—If not, what is the position of the crank when the piston is in the middle of the stroke

Answer—(a) — No. the reason for



PISTON AND CROSSHEAD LOCATION QUERY.

same being due to the angularity of the connecting rod. The relative difference may however, be reduced somewhat by increasing the length of the connecting rod. The space(d) is the distance that the crosshead is nearer the crank center when the crank pin is in a vertical position.

(b)—The skeleton sketch shows the position of the connections when the crosshead is midway in its stroke. The travel AB of the crosshead will equal the diameter a—b of the crank pin circle, therefore the distance c-o will equal the length of the connecting rod. Striking an arc with center at C and length C-O will give the position A of the crank pin when crosshead is in a central position.

* * *

Question—Sometime ago while turning a shaft, I was asked by a clerk for its weight, after considerable material had been removed. There being no tables at hand we made a guess at the weight. Is there any rule for finding the weight of round iron shafting?

Answer.—A fairly accurate method is to divide the square of four times the diameter by six, and multiply this by the length in feed. Example:—To find the weight of a piece of 4 inch round shafting, 3 ft. 8 ins. long, the above rule expressed as a formula becomes.

$$W = \frac{(4d)^2}{6} \times l = \frac{(4 \times 4)^2}{6} \times 3\frac{8}{12} =$$

$$\frac{16 \times 16}{6} \times \frac{44}{12} = 156\tfrac{1}{2} \text{ lbs. nearly.}$$

* * *

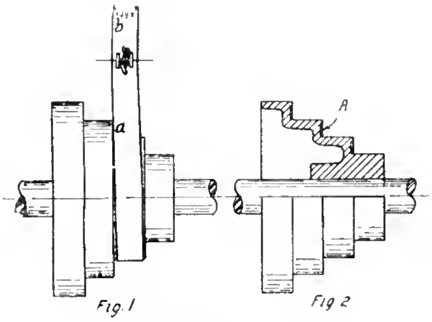
Question—What proportion of oxygen and acetylene burns in a blowpipe when welding by oxy-acetylene?

Answer—The ideal proportion should be 1 cu. ft. of oxygen to 1 cu. ft. of acetylene. In practice a little more oxygen is burnt than acetylene but the proportion of acetylene to oxygen should be as nearly as possible one to one. The same blowpipe using too high a pressure of oxygen will render this proportion less advantageous.

* * *

Question—What is the cause of a belt always having a tendency to climb up on to the larger step of a cone pulley? Sometimes it succeeds in climbing and this often results in the breaking of the belt, or it may commence to climb and twist completely over.—K. L.

Answer—The climbing of a belt may result from one of many causes or from the combination of several. The two cones may not line up with one another, the shafts may not be in alignment, the belt may not be properly laced or an accumulation of grease or belt dressing adhering to the side of the cone may result in trouble stated. If the joint is not properly cut and laced, as shown in Fig. 1, the portion between a and b will extend beyond the path of travel of the rest of the belt, and this section will want to climb. A very common cause of trouble is the use of too much belt dressing which in time gathers on the side of the cones. The belt in its motion comes in contact with this and causes trouble. Care should be taken



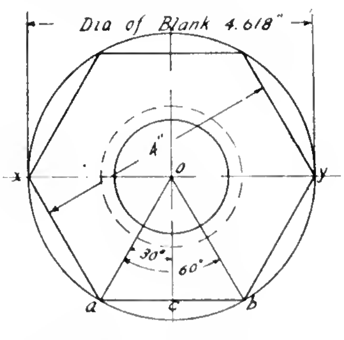
BELT CLIMBING QUERY.

to keep the surfaces of cone pulleys as free from dirt and grease as possible. All cone pulleys or those having flanges should have their sides undercut to reduce the belt friction as shown at (a) in Fig. 2. By this method, the belt only has a bearing on the sides of the cones at two points. Proper attention to belts is one of the chief essentials to successful production.

* * *

Question—What diameter of blank is required to obtain a hexagon which is to measure 4 inches across the flats?

Answer—As shown in the figure the diameter of blank will be equal to the length of the diagonal (x—y). As half the distance across flats (o—c) will equal 2 inches we have one side of the right triangle A C O. To find the length of hypotenuse (o—a) we have from the functions of trigonometry.



DIAMETER OF BLANK QUERY.

$$\text{hypotenuse} = \frac{\text{side adjacent}}{\text{cosine}} =$$

$$\frac{O—C}{\text{cosine of 30 deg.}} = \frac{2}{.86603} = 2.309 \text{ ins.}$$

Then diameter of blank = 2.309 × 2 = 4.618 inches.

NEW PROCESS DEVELOPMENTS

Inventive Genius and Research Operate to a Dual End — They Aim to Improve What We Now Possess and Bring to Our Service Commodities Before Unknown

PROTECTIVE COATINGS FOR METAL*

By H. B. C. Allison**

THIS brief review of some of the processes at present in use for protecting metals from oxidation will be confined to two types: firstly, that in which the metal itself is made more resistant, usually by some chemical treatment; and secondly, that in which another metal is used as a surface coating.

In the first instance, a coating is formed which must possess the following properties, if it is to be successful: It must be homogeneous, continuous, resistant to attack by acids or alkali, firmly attached to the base metal and must have a similar expansion coefficient. The ideal metal coating should also be homogeneous and continuous, but should be strongly electropositive to the base metal and should form electropositive alloys with it, so that in case of oxidation the coating will be attacked and the base metal protected.

As iron is the metal most commonly used as the base, the processes chosen will be those used for its protection, although some may be applicable to other metals. It was known for a considerable time before any process was devised that the black or magnetic oxide formed on iron, under certain conditions, was a very fair protective coating. Attempts to control and improve this coating have led to a number of patented processes, of which two may be taken as typical.

Bower-Barff Process

The pieces to be treated are heated to a temperature of 900 deg. C. in a closed retort. When this temperature has been reached, superheated steam is admitted for 20 minutes and a coating consisting of a mixture of red and black oxides is formed. Producer gas is then substituted for the steam and allowed to act for the same length of time. After cooling somewhat, the pieces are oiled and a smooth, green-black coating is produced, which affords efficient protection from sea water, acid fumes, etc., and will stand a wide variation in temperature.

Gesner Process

This is a further development of the foregoing process. The pieces to be treated are maintained at 600 deg. C. for 20 minutes, after which steam at low pressure is let in at intervals for 30 minutes. The steam, on entering, passes through a red hot pipe at the base of the retort, and is thus partially decomposed into hydrogen and oxygen. After this treatment a small quantity of naphtha or hydrocarbon oil is introduced and allowed to act for 15 minutes to reduce any red oxide, and also to carbonize the surface. The coating is said to be a compound of iron, hydrogen and carbon, and analyses have shown that a minimum of 2 per cent. hydrogen is present. It is an improvement on the Bower-Barff process in that the danger of warping, due to high temperature, is removed, the size of the piece is practically unaltered, and the tendency to scale is much less.

Both processes are quite expensive, but users have usually found the protection afforded of sufficient benefit to warrant the added expense.

Protection by Chemical Means

There is one process which may be of interest in this connection, known after its inventor as "Coslettizing." The pieces to be coated are first cleaned as usual, either by pickling or sand blasting, and are then placed in a boiling water solution of phosphoric acid, in which iron or zinc filings are always present. The period of treatment is from one-half to three hours, depending on the thickness of the coating desired. After drying, the pieces are usually oiled. By this treatment a very slight amount of the surface of the article is converted into certain phosphates of iron, but most of the coating comes from the solution itself.

This coating has been found to be particularly useful in the tropics, and is employed in one instance for typewriters. It is not a complicated process or an expensive one and the finish is very durable. It is, however, subject to patent restrictions.

Protection by Another Metal

The agent used in the majority of cases for protecting iron is the metal zinc. Zinc is strongly electropositive to iron and so are its alloys, if free from impurities. It is also readily available and may be applied by a number of processes.

Hot Galvanizing

The oldest process is that of hot galvanizing, which consists simply of cleaning the piece, coating with a suitable flux and then dipping in the molten zinc. The piece is usually wiped after this to improve the coating. This process has the disadvantages of limiting the thickness of the coat, of plugging any small holes, of the composition of the coating being variable, and the possibility of including injurious and corrosive substances in the coating, which may cause early failure.

A modification of this process is known as the Lohman process. After cleaning, the article to be coated is dipped in the Lohman bath, which is a solution of hydrochloric acid, mercuric chloride and ammonium chloride; it is then dried before immersing in the molten metal, which may be any one or a mixture of a number of metals such as lead, zinc, and tin. The chief point in its favor seems to be that the junction between the iron and the protective alloy is kept free from all oxide, and, therefore, the alloy will fill all the pores and no corroding agent can be included.

It is claimed by its backers that a graduated alloy is formed so that the protective coating cannot be completely broken through except by breaking the sheet itself.

Cold Galvanizing

Another process being used more and more as it is improved is that of wet galvanizing or electroplating. In this case the article to be coated is suspended as a cathode in a suitable bath and is subject to easy control. It provides a coating of high purity and uniform thickness in general, but recesses and corners cause some trouble. It is liable to be more or less porous and may contain acid which will eventually cause failure. In both of these processes, hot or cold, the coating does not become intimately connected with the base metal through deep alloying.

Sherardizing

The latest process of this type is sherardizing, and it is undoubtedly the most perfect as a protection. The object to be sherardized is placed in an iron drum which is filled with a mixture of finely powdered zinc and zinc oxide in varying proportions, and is heated in a reducing or inert atmosphere for a period of time, the length of which depends on the thickness of coating desired.

The coating so obtained consists of four protective layers. Next to the pure iron is an alloy C, rich in iron, upon which is another definite alloy B, containing more zinc. Then there is a layer containing a number of more or less unknown alloys, and finally a layer of pure zinc. This makes a coating which is not easily broken down and which is continuous. The principal objections to its use are the high tempera-

*General Electric Review.
**Of Reserch Laboratory, General Electric Co.

ture to which the piece must be subjected and the increase in size which may be caused.

The theory which has been advanced to explain this process is interesting in that it may be considered as a distillation process. The zinc dust which is obtained from the zinc smelters is said to be in a state of unstable equilibrium, so that in contact with the hot iron it undergoes a change tending to restore it to the normal condition. During this change some of it alloys with the iron, thereby lowering the vapor pressure for zinc in that region. A slow distillation then begins from the zinc nearest the object itself. As the alloy becomes richer in zinc the difference in vapor pressure becomes less and less and then finally becomes zero. This is found to be the case in practice. The deposition becomes slower as the time is extended.

Calorizing

This recently developed process makes use of aluminum as the protective metal and is of particular advantage in preventing oxidation at high temperatures. The protective action is due to the oxide formed by the action of heat on the protecting metal, rather than to any electrolytic relations between the aluminum and the base.

It has been found very useful in the case of iron utensils subject to direct contact with flames at temperatures up to 1,000 deg. C., and also in the case of boiler tubes, for the life is increased many times by this treatment and the saving in the cost of replacements is much greater than the additional initial cost of calorizing.

Schoop Process

One of the most recent processes, and one of the most promising, is the Schoop process. This is applicable to the deposition of metals or alloys on any sort of an object. The apparatus consists of a pistol into which the coating metal is fed as a wire. It passes through a straightening and centreing device into the nozzle, where it is fed through a burner whose temperature may be regulated from 700 deg. to 2,000 deg. F. The molten metal is carried a short distance by the gas current and is suddenly caught by a powerful blast of compressed air which shoots it out of the nozzle with a velocity of 3,000 feet per second, directly on the object to be coated, which is held a short distance away. The coating is homogeneous, continuous, and of any desired depth, and is also exceedingly intimate.

The theory of the Schoop process as given by its inventor, is that the gaseous medium used is much larger in volume at any moment than the drop it has pulverized and is carrying, and the gas is expanding so rapidly that its temperature is far lower than that of the spray. A rapid exchange of heat, therefore, takes place between them, which consolidates the molten particles and gives them a temperature far below the melting point. If the particles arrived in a liquid state at the base with the observed velocity of 3,000 feet per second, they would simply splash on the surface and largely rebound. As a matter of fact they impact and inter-penetrate freely, and the later bombarding particles unite with the earlier ones to form homogeneous compact bodies.

In accounting for the observed action of the Schoop spray at the receiving base, it is supposed that the cooled particles of the metal just before impinging with great velocity on a hard surface, are in an abnormal physical condition. Due to the heat of collision they pass directly into a vapor which condenses and solidifies on the relatively cold receiving body, penetrating by osmotic pressure the superficial pores of the base when an affinity for the latter exists, and otherwise driven in by the pressure behind it. In either case it condenses and solidifies after penetration, and is effectively dovetailed into the base. The hammering and bombardment of the solidified first coat by the minute succeeding particles is practically a process of cold working. The entrained particles liquidify and solidify so rapidly that the metal has not time to return to its natural crystallized state."

There are many other processes in use, those outlined being chosen as representative of the various different means employed to obtain the desired protection because of their prominence, or of some new feature which they contain.

CO-EFFICIENT OF FRICTION OF BELTING MATERIALS

AN investigation has been made for a firm of belt manufacturers into the properties of driving belts of various materials. Determinations were made of the co-efficient of friction with different values of tension on the belt and also of the stretch for different loads. In order to determine the co-efficient of friction, the belt was placed over a pulley attached to the mandrel of a lathe, and both ends of the belt made fast to loaded levers, by means of which the tension in the belt could be adjusted. One lever end was attached to a spring balance, and, on rotating the pulley, the friction lifted the load on this lever and registered a pull on the spring balance attached. The other end of the belt remained under the tension due to the loaded lever at its end. The values of the tension on the two sides of the friction pulley being thus observed, the co-efficient of friction could be calculated.

The materials tested included ordinary leather, balata, cotton, and several hair belts. The following values were obtained for the co-efficient of friction and the stretch, the figures being tabulated for a tension of 200 lb. per inch width and for 800 lb. per square inch. The width of all the belts was 4 in.

Tests of Belting Materials

Total load (200 lb. per inch width))= 800 lb.:

Material.	Area in sq. ins.	Coeff. of friction	Stretch per cent.
Ordinary leather......	1.07	.34	3.2
Rawhide	.58	.38	2.5
Balata	.98	.54	1.6
Cotton	1.16	.28	1.3
Ordinary hair belting.	1.32	.24	1.9
Patent hair belting (1)	1.30	.41	1.4
Patent hair belting (2)	1.62	.79	1.4

Load 800 lb. per sq. inch:

Material.	Area in sq. ins.	Total load	Coeff. of friction	Stretch per cent.
Ordinary leather..	1.07	856	.35	3.4
Rawhide	.58	464	.66	1.3
Balata	.98	784	.54	1.6
Cotton	1.16	928	.29	1.3
Ordinary hair belting	1.32	1056	.26	2.1
Patent hair belting (1)	1.30	1040	.37	1.9
Patent hair belting (2)	1.62	1296	.80	2.0

These figures show that the advantage of the more modern belting materials over the ordinary leather is rather in the reduction of stretch than in any improvement in co-efficient of friction. They also exhibit the reason for the superiority of rawhide belting, which, although very light, stretches but little, and has a very high co-efficient of friction as long as the tension is not made too great. The behavior of the hair belting is also interesting, the ordinary belting being very similar to cotton, while the possibility of improvement by treatment is shown by the two patent hair beltings tested.

The co-efficient of friction did not prove to be constant at all tensions, nor was the behavior of all the substances the same with regard to the influence of the tension on the co-efficient of friction.

French Fuse.—The fuse of the famous 75 field gun consists of a sealed tube of tin containing burning composition, wound in a spiral round the head of the shell. In the head of the shell are holes communicating with the explosive within. The fuse is set by piercing it in a special machine which forces the sealed tube through the hole in the shell head at a point depending on the time after firing that the shell is set to explode. When the flame of the burning composition reaches the pierced point it ignites the explosive.

What to Ask For.—Get the habit of ordering drills by their diameter in decimals. Don't try to remember the numbers of drill gauges that never should have been made.

Plating and Polishing P ant of the Russell Motor Car Co.

By Walter S. Barrows*

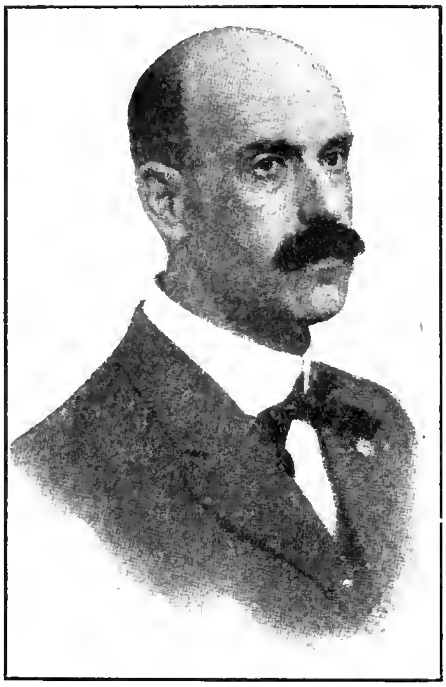
The product of this company at West Toronto, Ont., has always been characterized by its excellence of finish. Few people are aware of the scientific knowledge and practical skill necessary to insure continuous successful operation of a plating plant. Again when the actual quantity of work produced is taken in consideration, the necessity for efficient equipment and help becomes increasingly evident if required output is to be maintained.

THE plating and polishing departments of many industrial plants are usually the least interesting features shown the visitor. This fact is contrary to what one might expect. The plating and polishing department of the Russell Motor Car Co.'s Works at West Toronto is, however, an exception, and enjoys the distinction of being the finest in Canada. The cleanliness of this department has created considerable comment among men who know the existing conditions in similar departments throughout the North American continent.

Electrical Equipment

The equipment generally is very complete, the high quality of product required necessitating the installation of none but the most modern and efficient apparatus. The electrical units consist of two direct current dynamos, one supplying current at 10 and 5 volts with a three-wire system, and the other supplying a 6-volt current.

The latter is a shunt wound multipolar machine having a capacity of 2,500 amperes, and is operated in connection with a 3,500 gallon nickel solution. The copper plating tanks, brass plating baths, mechanical platers, etc., are supplied with 5-volt current from the first mentioned dynamo, while the 10-volt circuit from the same machine is employed in the operation of electro-cleaning solutions, and experimental baths. The capacity of this three-wire dynamo is 1,800 amperes. The entire power section of the department is separated from the



WALTER S. BARROWS.

plating section by glass partitions, the polished metal parts of the machines, and all connections, bus bars, etc., within the power section being kept scrupulously clean and bright.

Each tank in the plating room is connected to a voltmeter, portable ammeters being used on all tanks, while the rheostats of the rectangular switch board type, are so wired as to permit the use of suitable current densities without undue heating.

Nickel and Copper Baths.

The nickel baths average 225 gallons per tank, and are nearly all of the double row type employing three rows of anodes. Upwards of 4,000,000 bicycle spokes are plated annually in still solutions, the result being a practically rust proof spoke the reputation of which has spread to all parts of the world.

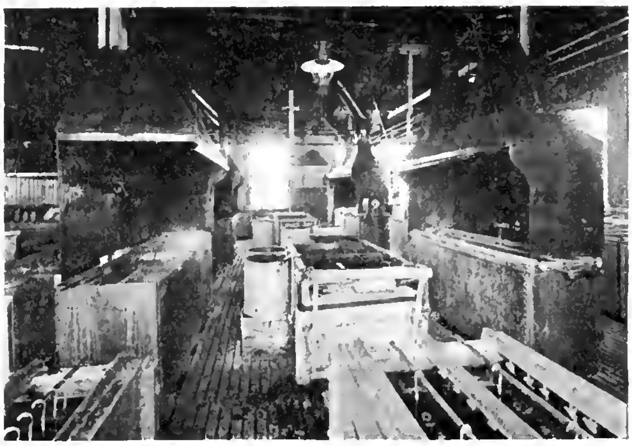
A cyanide copper solution of 600 gallons is used in copper plating all steel parts previous to nickel plating. The copper plate is exceptionally heavy and durable, no competition or rush orders being allowed to interfere with the recognized standard of plating in this establishment. Exceptional care is taken in the preparation of all parts before treatment in the plating solutions, over 700 gallons of alkaline cleaning solutions being employed for this purpose. Electric cleaners with double throw switches are operated with a 10-volt current.

The famous "solid brass" plating produced by this company is the result of persistent efforts on the part of the foreman in charge. Copper and zinc anodes are used in the brass bath, and the electrolyte is a very simple and inexpensive solution.

Plating Small Parts

Bicycle spoke nipples, and parts of similar size are plated in mechanically operated cylinders, rotated while immersed in a concentrated nickel solution.

SHOWING ARRANGEMENT OF NICKEL BATHS. POWER SECTION IN BACKGROUND.



COPPER PLATING AND CLEANING SECTION SHOWING ACID JARS AND SWILLING TANKS.

*Foreman, Electro-plating Dept., Russell Motor Car Co., Ltd.

This treatment produces polished and plated parts in large quantities with a minimum of labor.

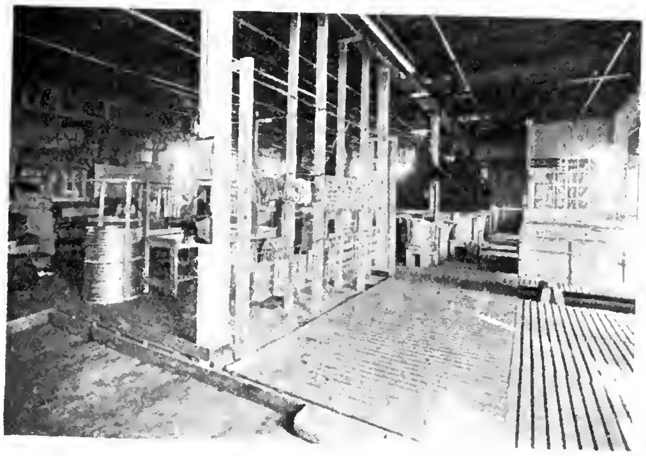
The plating room while located on the third floor is supplied with an excellent drainage and ventilation system. The floors are of concrete faced with asphalted tar paper, and protected by wooden slats. All water is conducted to a drain at the centre of the floor, and the department is well flushed and scoured once each week. Ventilation is effected by means of hoods placed above each tank containing solutions from which emanate strong fumes or steam during operation of the bath. The larger of these hoods are connected direct to outside draft, while the smaller hoods are connected to a rotary suction fan.

Parts for between 20,000 and 30,000 bicycles are plated annually, together with parts for 120,000 skates, and thousands of automobile parts. Special solutions are operated for special lines of work and the latest developments in electroplating are put to a severe test. The department is equipped with a chemical laboratory for the study of various solutions, and the perfecting of ideas which may be of commercial value to the business. The recent tests of cobalt plating solutions carried on at this plant have added a new and valuable chapter to modern electro-plating literature. Upon entering this very interesting department the visitor is impressed with the neat and clean appearance of everything, each employee being trained to do his share toward maintaining system, efficiency and cleanliness. A ball burnishing and wet tumbling section is included in the plating room. Here aluminum and steel parts are economically processed preparatory to plating. One of these tumbling barrels is the largest barrel operated in any plating department in Canada, it having a capacity of approximately 200 gallons.

Polishing and Buffing

The polishing, grinding and buffing department is located on the same floor with the plating room, but separated from the latter by a storage room. In the polishing room 35 men are employed, and the working conditions are as nearly ideal as modern ventilating machinery will permit. The blower system is worthy of particular attention as it is unusually large and efficient. The sanitary condition being well taken care of. The room is airy, well lighted and kept clean and neat in every detail. The polishing machinery is operated by separate motor power, and the entire department is being equipped to facilitate heating by exhaust steam.

In the manufacture of automobiles, bicycles and skates, the necessity for care and skilled workmanship exists in every department, but if the final finish of enamel or plating is not satisfactorily effected the product cannot become a leader in its respective line. All the products of this company are protected and finished "up to a standard not down to a price."

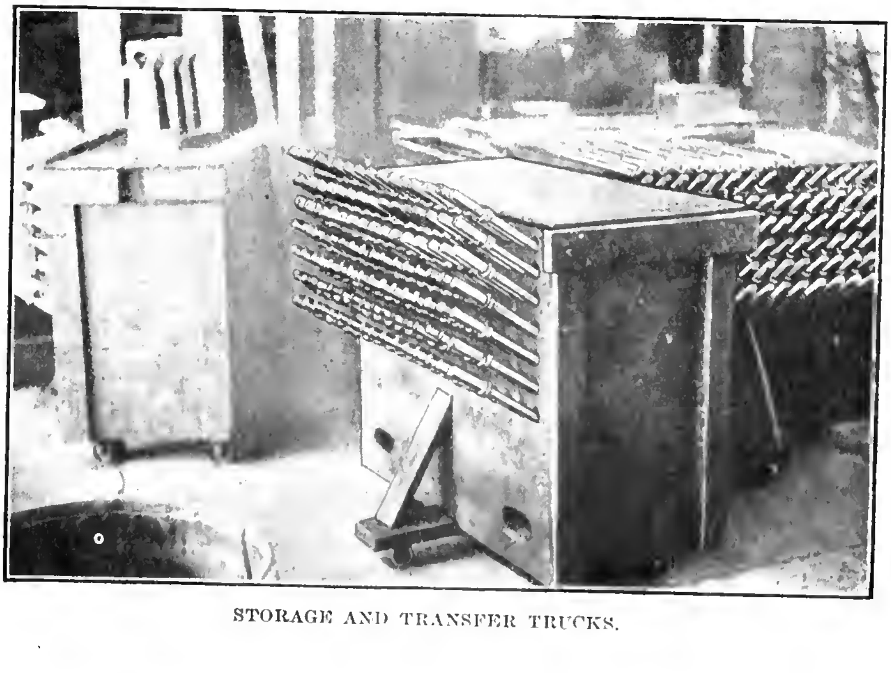


GENERAL VIEW OF PLATING ROOM FROM ENTRANCE. FINISHED WORK SECTION IN LEFT FOREGROUND.

STORAGE AND TRANSFER TRUCKS.

By G. Lock

THE trucks here shown, are used by the Henry & Wright Co., Hartford, Conn., to hold finish-ground drilling machine spindles. Kept in this way the spindles may be easily run wherever wanted, are free from danger of being "bruised", and at the same time are convenient to get at. The inside of the box-body has sloping shelves with heavy cleats to separate the spindles. The same idea is applicable to numerous other kinds of work.



STORAGE AND TRANSFER TRUCKS.

ELECTRICITY FROM BELT SLIP

THAT the unavoidable slight slip of all running belts on their pulleys produces static charges of electricity in these two bodies has often been remarked, and it has sometimes been suggested that this has been the cause of mysterious explosions in powder works. Interest, therefore, attaches to a simple device for removing this charge, described by W. T. Estlick, in the Electrical Review and Western Electrician.

It was used in a textile mill where cotton looms were running with rubber work, so that it was necessary to keep the room perfectly dry. These conditions caused the accumulation of large charges of electricity in the belts of the motors driving the looms, with the result that the belts attracted all the particles of lint floating about, eventually shaking them on to the yarn and making the work dirty. The bits of lint would also gather in the motor, and when this was blown out would settle on the work.

On two occasions also a squirrel-cage motor burnt out, apparently from no other cause than that of the charge in the rotor discharging to earth by sparkling across on to the stator winding and puncturing the insulation. Copper strips connected to earth were then placed above and below the belt, brushing lightly against it. After this no more burning out occurred, and the collection of the particles of lint was also prevented.

"GASOL," a semi-natural gas, is being introduced as a substitute for acetylene and hydrogen for autogenous welding.

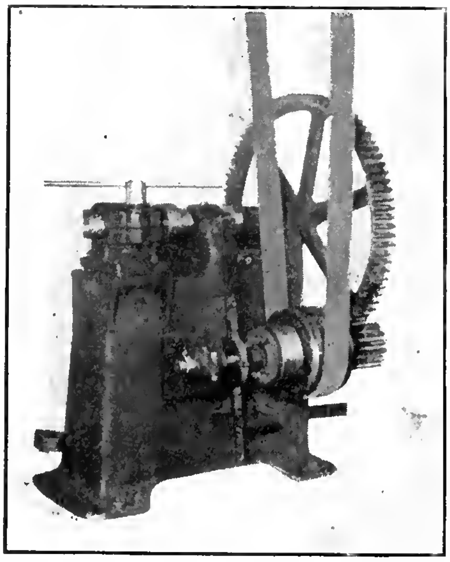
PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Machine, Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

DRIVING HOME H.E. SHELL BASE PLATES

A MACHINE of entirely new design for use in plants making high explosive shells has been developed and built by the Holden-Morgan Co., Toronto. Until the appearance on the market of this machine, the plug has had to be screwed into the shell base by means of a hand wrench, a somewhat slow and laborious method. The accompanying illustration shows clearly the main features of the machine and the following brief description will serve to explain the design and method of operation.

The bed of the machine is a hollow iron casting supporting two bearings for the spindle and a table for the vise. At the side of the bed, low down, are two brackets holding a shaft with a pinion, pulley and friction clutch. The pulley is driven direct from the main shaft by a 4-in. belt, and is continuous running, no countershaft being necessary. A large spur gear is keyed on the end of the upper spindle, the gear wheel being driven by the pinion on the clutch shaft. At the end of the spindle is a chuck made to take the square end of the base plug. In front of the coil spring is a collar fastened to the spindle and against this collar are two fingers or prongs operated by foot lever in front of the machine.



MACHINE FOR DRIVING HOME H.E. SHELL BASE PLATES.

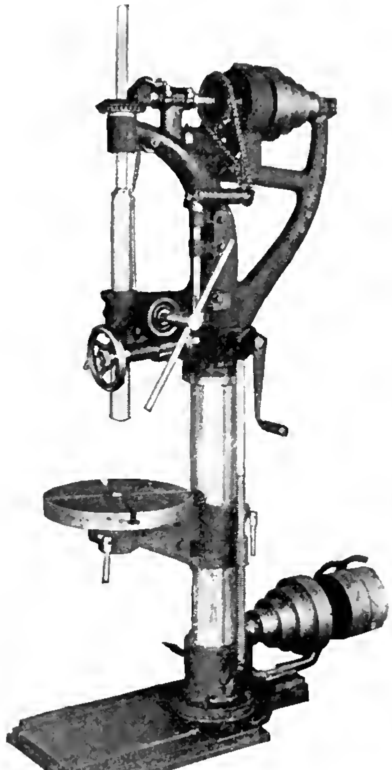
The operator having first entered the plug in the base recess, places the shell in the vise with the square end of plug in the chuck. By means of the foot lever he draws the spindle back and with it the gear wheel and chuck, at the same time pressing the shell towards the chuck. When the spring is closed, the shell is tightened in the vise and the clutch at the side thrown in, and while the spindle is revolving, the plug is being screwed into the shell base. At the same time, the spindle is being forced towards the shell by the spring, thus following up the plug as it enters the base. By this arrangement it is impossible for the end of the plug to come out of the chuck. When the plug is driven home the tension is thrown back to the clutch which slips, and the operator throws it out.

The friction device on the clutch is adjustable and can be set for any desired tension. When set, the pressure applied will not vary from the desired adjustment. The whole operation, being mechanical, eliminates the variations that result when the plugs are screwed in by hand. The machine is of simple design and substantial construction and contains very few parts that can get out of order. It is perhaps the most efficient labor and time saving machine that has been put on the market since the manufacture of shells was first started.

DRILL WORKER ON H. E. SHELLS

AT the shell plant of Canadian Blower & Forge Co., Berlin, Ont., what is known as their "Canadian" 20 in. drill has been adapted for all of the lighter operations in place of the heavier type of machines. The drill is giving especially good service on sizing the threads. On the British 18pdr. high explosive shell, there is a thread 1¼ in. long on the inside, and of 2 in. diameter No. 14 whitworth gauge right hand. This thread must be acurately sized with a variation of not more than .002. The drill referred to is we understand doing this work with perfect accuracy and cutting a clean thread. It is further equipped with a milling cutter which re-sets the bevelled surface at the end of the shell on which the fuse rests.

For reaming the sides and finishing the bottom a modification of the standard drill has been made. The automatic power feed-travel-spindle has been increased to 14½ in. and is controlled throughout its travel by an automatic trip, which can be adjusted for any predetermined depth. The tripping mechanism which is on the hand lever shaft is new and novel and does away with the spindle sleeve clamp type of trip. The new arrangement permits a length of automatic feed equal to the full travel of the spindle. The single feed of .030 of an inch per revolution of the spindle for this particular drill is positive and is obtained through two sprockets and a linked chain. Three stop cones can be substituted for the chain drive and speeds of .004 to .007 and .012 of an inch obtained. The drill has hand, lever and automatic feeds, so that practically any condition of feed can be met.



DRILL FOR LIGHTER OPERATIONS ON H.E. SHELLS.

The crown gear runs in a renewable bronze bushing thereby eliminating bother and expense of rebabbitting with the chance of getting the spindle out of alignment. The drill spindle has a No 4 "Morse" taper, and the key drift slot is below the sleeve, so that the key drift can be used with spindle in any position. The greatest distance from the spindle nose to the table is 20½ in., and from the nose to the base 36½ in.

CARTRIDGE CASE TRIMMING LATHE

THE Canada Machinery Corporation, Galt, Ont., have placed on the market a lathe which has been specially designed to finish the British 18 pdr. shrapnel

cartridge case, and also the 4½ inch British howitzer cartridge case. The lathe work necessary to be performed, is accomplished at one chucking of the case.

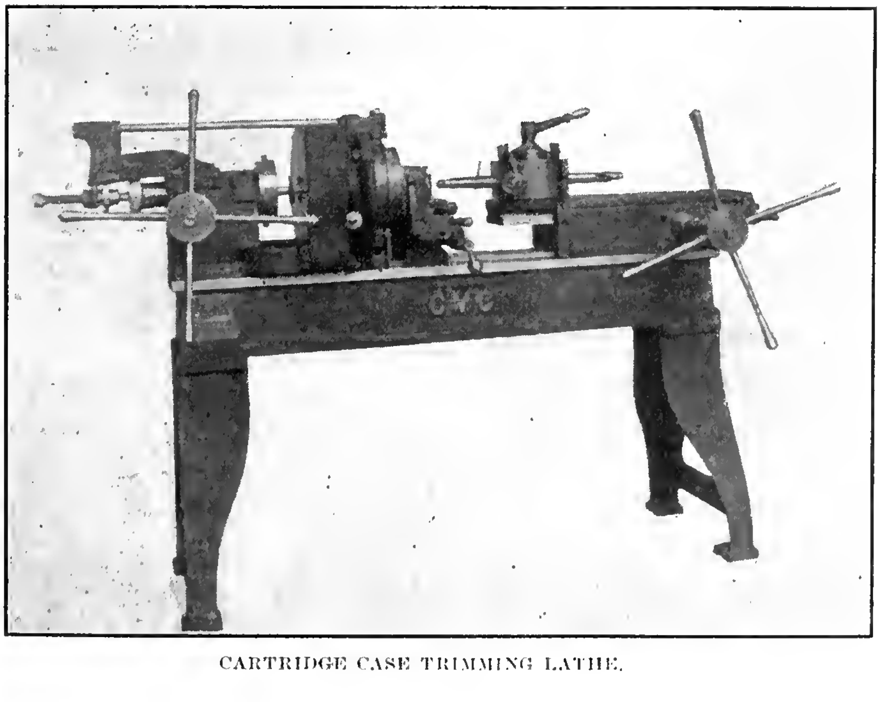
The spindle is made about ¾ in. less in length than the shrapnel cartridge case, allowing thereby the ends of the latter to project so that machining may be performed at both ends. The spindle and pulley are in one piece, and the spindle runs in a cast iron bearing sleeve, which is gripped tightly in the head by means of the top cap. At the front end of the spindle, a lever operated chuck is carried. This chuck has two sets of jaws, one for shrapnel cases, and one for howitzer cases. The chuck can be adjusted by means of a nut in order to make it grip firmly, should any slight variation occur in case diameters.

The chuck lever is in a convenient position at the front of the head, and the continued movement of this lever after releasing the chuck operates an ejector rod for ejecting the case out of the chuck when finished. This ejector rod is also used as a stop rod when putting the cases into the spindle, in order to give the correct projection of the head of the case front of the chuck. An adjustment is provided on this stop rod by means of lock nuts at the rear of the head. A cross slide operated by means of a ball handle and screw is provided with back and front form tools for forming the shape of the head, and with a facing tool having an independent adjustment in relation to the form tools, for setting to the head thickness. Dead stops with a fine adjustment are provided for the cross slide.

The tools for boring, recessing and threading the hole in the head of the case, are carried in a four tool turret. This turret has an automatic revolving motion operated by means of the backward movement of the pilot wheel. For boring out the mouth of the cartridge case and facing off the end to the proper length, a back cutter head is carried in the headstock, and is traversed by means of the pilot wheel, pinion and rack shown at the rear of the head. The cutter head is traversed forward until the stop on the back of its sleeve strikes the boss at the back of the head. This stop is adjustable on the sleeve and governs the length of the case trimmed. One facing tool and one boring tool are carried in the back cutterhead, the boring tool being provided with fine adjustment for diameter. A leather disc is also carried in front of the rear end cutter head to clean out the cuttings from the mouth of the case, preventing them from lodging in the inside of the spindle.

The mouth of the case is centered in the rear of the spindle by means of a floating centering collar, which provides for any slight variation in case mouth diameter. The lubrication of the spindle has been given special attention, oil being carried to the spindle bearing by means of a felt pad from an oil reservoir at the bottom, in addition to a sight feed lubricator on top.

This machine it is claimed will finish British 18 pdr. cartridge cases at the rate of twenty-five per hour.

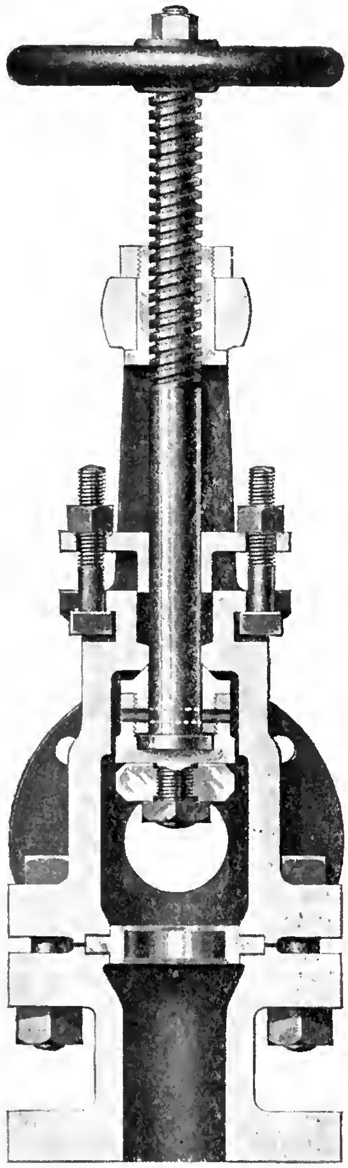


CARTRIDGE CASE TRIMMING LATHE.

RENEWABLE BLOW-OFF VALVE

ONE of the most notable evidences of the safety first movement is observable in the increased precautions which are now taken to insure absolute safety in the operation of boilers. Among recent developments, the adoption of double valves on the blow-off pipe has called forth new examples of the valve-maker's art.

The Homestead Valve Manufacturing Co., Inc., of Homestead, Pa., have designed and placed on the market an angle type of blow-off valve, under the name of the "Hovalco." The double valve arrangement usually consists of two valves of different types, say a plug cock and an angle valve, or a gate valve and an angle valve. The "Homestead" valve, which is of the plug-cock design, has been favorably known for many years, and it was the company's desire to supplement this in order to meet modern conditions, which led them to produce the angle type valve shown in the illustration.

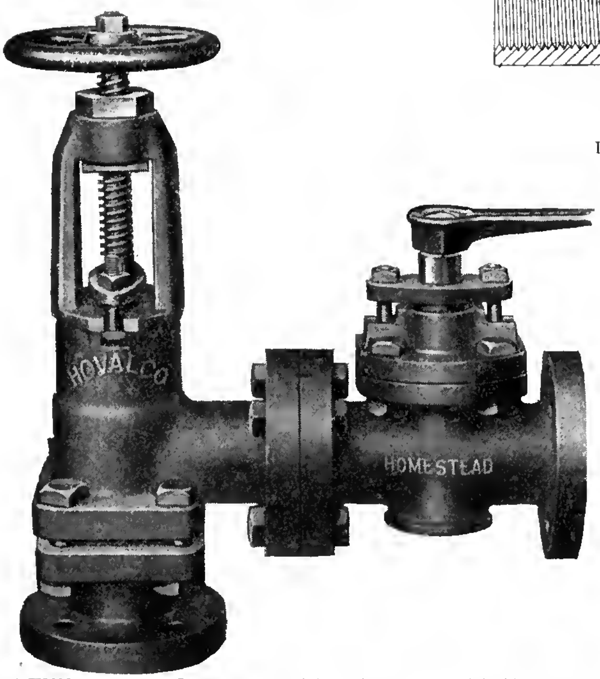


SECTION OF REGRINDING AND RENEWABLE BLOW-OFF VALVE.

The valve is of the re-grinding and renewable description, and combines high-grade materials with excellent design and manufacture. Both the disc and seat are of monel metal, the anti-

corrosive properties of which make it particularly suited for this work. In addition to being of the re-grinding type, the design of the valve is such that both disc and seat can be quickly reversed, thus practically doubling the term of service before repairs are necessary.

The body of the "Hovalco" valve is made of semi-steel and all trimmings of high-grade bronze. All-bronze valves can be supplied also. Access to the interior is obtained by removing four bolts



RENEWABLE BLOW-OFF AND QUARTER TURN VALVES.

which hold the parts of the valve body together. Some State authorities have already passed laws requiring double blow-off valves and combinations of the nature described, by means of which the angle valve can be renewed, reground, or overhauled by simply closing the quarter-turn valve, thus avoiding closing down the boiler or other interference with plant operation.

THE "DEAN" BOILER TUBE CLEANER

THE "Dean" Boiler Tube Cleaner possesses the unique feature of being adaptable for use in either water tube or return tubular boilers. By simply changing the vibrator head or hammer, the cleaner becomes equally efficient in removing scale from the interior or exterior of boiler tubes. The device is purely vibratory in its action, being therefore entirely free from any boring, scraping or other cutting or frictional action.

A sectional view of the apparatus is shown in Fig. 1, from which it will be seen that the vibrating head might be likened to a power operated pendulum, and its effect on the walls of the tube is to create a state of localized vibration or tremor such as is caused in a bell when struck by the clapper. Owing to the difference in hardness and strength between hard scale and steel boiler tubes, the scale is physically unable to vibrate at the high speed of the steel. Consequently, the surfaces in contact are separated from each other almost immediately, and a continuance of the vibration produces an internal disintegration of the scale causing it to fall away from the tube surfaces in small pieces, which, in the case of water tube boilers, are expelled from the tube by the exhaust air or steam which operates the cleaner.

This peculiar action renders the "Dean" tube cleaner particularly efficient in removing scale from corners, crevices, or joints which are difficult of access.

Referring to Fig. 1, the vibrator (a) is hinged at (b), and carries at its outer end, the vibrator head (c), while the other end is formed so as to operate in

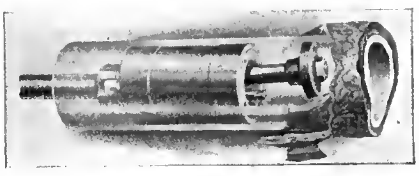


FIG. 3. REMOVING SCALE FROM OUTSIDE OF BOILER TUBE.

valve (d). The hinge (b) is carried by body (e) in which are formed passages (f), one end of which is controlled by valve (d), the other ends entering cylinder (g) at opposite ends. Piston (h) surrounds vibrator (a), a ball and socket arrangement being provided so that vibrator (a) may be moved by piston (h).

With the vibrator head in the lever

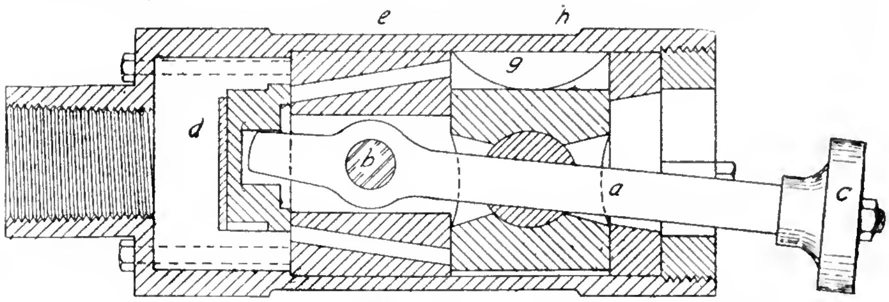


FIG. 1. SECTIONAL VIEW OF "DEAN" BOILER TUBE CLEANER.

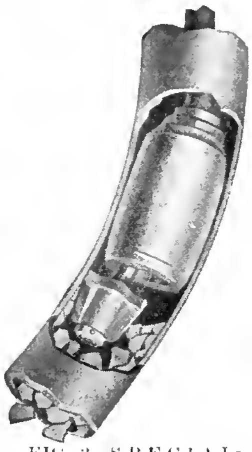


FIG. 2. SPECIAL TYPE OF CLEANER FOR "STIRLING" BOILER TUBES.

position as shown, the valve admits the working fluid to the lower end of the cylinder whereupon the piston is instantly forced upward carrying the vibrator with it, and causing the head to make impact with the upper side of the tube. The action of the vibrator causes the valve to travel downward and uncover the upper passage to the cylinder, thus returning the piston to the position shown.

The tapping action takes place at the rate of from 3,500 to 10,000 times per minute and gives rise to the series of vibrations in the boiler tubes which result in the scale automatically detaching itself from the surface. Again, the vibratory movement can be regulated to such a mechanical nicety that at the highest possible speed the tube is not subjected to hammering in the usual sense of the word—a gentle tapping of very high frequency being what actually takes place.

The actual force of the tap is equival-

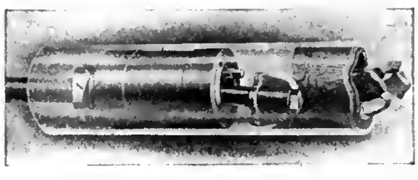


FIG. 4. REMOVING SCALE FROM INSIDE OF BOILER TUBE.

ent to 2½ foot ounces, and with 70 to 90 lbs. pressure it vibrates at a speed of 5,000 to 8,000 times per minute. The Dean cleaner is manufactured by the William B. Pierce Co., of Buffalo, N.Y.

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AN UNEXPECTED VERDICT

THE tenor of the speech given by D. A. Thomas before the Montreal Branch of the Canadian Manufacturers' Association on Friday last cannot be described as reassuring from the viewpoint of Canadian shell makers. While all loyal manufacturers must hope that Mr. Thomas' meaning has been misinterpreted, the fact that Major-General Sir Samuel Hughes has taken exception to several inferences, would indicate that Mr. Thomas' visit to Canada is utterly barren of those results which many of us had so fondly anticipated.

Coming as it did soon after Lord Curzon's unfortunate contretemps in the House of Lords in connection with Canada's supply of munitions, the visit of the Welsh magnate was expected to counteract the temporary pessimism induced by the noble lord's remarks. Hope ran high regarding the happy impression which personal observation would make upon the visitor, and coming as he did in the capacity of personal representative of Lloyd George, the least that could be looked for was that our methods and our men would appeal more strongly than ever to one whose business capacity had brought him into such direct contact with the British Minister of Munitions.

Either the ability of Canadian munition makers has been grossly exaggerated or Mr. Thomas' qualifications as official observer are decidedly over-rated. Strictures such as he is reported to have made regarding unsatisfactory delivery, and allegations as to higher prices demanded would never have been made by a person acquainted with the real history of shell making in this country.

If the personal qualifications necessary for the successful control of large business interests, the ability to judge men, observe conditions, weigh up past performances, and deduce future accomplishments had been freely exercised, above all if the intense desire and obvious capacity of Canada to render a creditable account of herself in supplying munitions had been fully appreciated by Britain's Envoy, the present regrettable controversy would never have developed.

One of the first principles in controlling labor, and it applies to firms as well as individuals, is to pile up the work ahead to such an extent that there is no time to think of what is going to happen when the immediately present job is through. No one knows when the war will be finished, but everyone knows that while the war lasts, shells will be needed, and needed badly. We do not say that the supply of shells from this country will continue till the actual conclusion of hostilities, but what we do say is this: If the supply of shells from Canada is to continue for an indefinite period, we ought to know it and know it now.

While exact information regarding results in British factories is unavailable, there can be no doubt in the minds of our manufacturers here regarding the results of a comparison. Consider the difference in conditions. Thousands of miles from the source of the business, the conspicuous absence of instructors and advisors, the altogether conspicuous presence of inspectors and ultra-rigid specifications, latterly the omnipresent but oft delayed vision of completed contracts and idle factories,—consider all these things in the light of industrial enlistment so strenuously being carried out in Britain, and then consider how Canadian manufacturers as a body continue to maintain an attitude of solicitous effort in their desire to render service to the Empire.

If there still remains any doubt as to the loyalty of Canada's efforts, the fullest refutation is contained in Major-General Hughes' statement: "No shells whatever were produced in England by commercial organizations until months after Canada had made delivery. Not one shell was produced in any commercial institution in the United States until long after Canada had been producing enormous quantities. Canada's Shell Committee has led the world in this line. The regular manufacturers of war material in the United States and Great Britain were also far behind the Canadian commercial industries relatively, in their deliveries. The Canadian Shell Committee . . . . was not free to enlarge its sphere of action. Had it received large orders at the beginning it would have been able to rival the entire output of the United States and Britain in quantities, but the orders came piecemeal, and each was supposed to be the last."

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey forge, Pittsburgh	$14 70	
Lake Superior, charcoal, Chicago	15 75	
Ferro Nickel pig iron (Soo)	25 00	

	Montreal.	Toronto.
Middlesboro, No. 3	22 00	.....
Carron, special	23 00	.....
Carron, soft	23 00	.....
Cleveland, No. 3	22 00	.....
Clarence, No. 3	22 50	.....
Glengarnock	26 00	.....
Summerlee, No. 1	28 00	.....
Summerlee, No. 3	27 00	.....
Michigan charcoal iron	26 00	.....
Victoria, No. 1	23 00	20 50
Victoria, No. 2X	22 00	20 50
Victoria, No. 2 plain	22 00	20 50
Hamilton, No. -	22 00	20 50
Hamilton, No. 2	22 00	20 50

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	2.20
Steel bars, f.o.b., Toronto	2.20
Common bar iron, f.o.b., Montreal	2.20
Steel bars, f.o.b., Montreal	2.20
Twisted reinforcing bars	2.20
Bessemer rails, heavy, at mill	1.25
Steel bars, Pittsburgh	1.30
Tank plates, Pittsburgh	1.30
Beams and angles, Pittsburgh	1.30
Steel hoops, Pittsburgh	1.50
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.10
Small shapes	2.35
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.90
Structural shapes	1.95
Plates	1.95

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ¼ to ½ in., 100 lb.	$2 35	$2 25
Heads, per 100 lb.	2 55	2 45
Tank plates, 3-16 in.	2 60	2 45

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$12 25	$12 00
Copper, crucible	14 25	13 50
Copper, unch-bled, heavy	14 25	13 50
Copper, wire, unch-bled	14 25	13 75
No. 1 machine compos'n	11 50	11 50
No. 1 compos'n turnings	10 00	9 50
No. 1 wrought iron	10 00	9 50
Heavy melting steel	8 00	8 00
No. 1 machin'y cast iron	13 50	11 00
New brass clippings	11 00	11 00
No. 1 brass turnings	9 00	9 00
Heavy lead	4 50	4 50

Tea lead	$ 3 25	$ 3 50
Scrap zinc	10 50	9 50

W. I. PIPE DISCOUNTS.

Following are Toronto jobbers' discounts on pipe in effect Aug. 27, 1915:

	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
Standard				
¼, ⅜ in.	63	38½	....	....
½ in.	68	47½	....	....
¾ to 1½ in.	73	52½	....	....
2 in	73	52½	69	48½
2½ to 4 in	73	52½	72	51½
4½, 5, 6 in.	....	....	70	49½
7, 8, 10 in.	....	....	67	44½
X Strong P. E.				
¼, ⅜ in.	56	38½	....	....
½ in.	63	45½	....	....
¾ to 1½ in.	67	49½	....	....
2, 2½, 3 in.	68	50½	....	....
2 in.	....	....	63	45½
2½ to 4 in.	....	....	63	48½
4½, 5, 6 in.	....	....	66	48½
7, 8 in.	....	....	59	39½
XX Strong P. E.				
½ to 2 in.	44	26½	....	....
2½ to 6 in.	....	....	43	25½
7 to 8 in.	....	....	40	20½
Genuine Wrot Iron.				
⅜ in.	57	32½	....	....
½ in.	62	41½	....	....
¾ to 1½ in.	67	46½	....	....
2 in.	67	46½	63	42½
2½, 3 in.	67	46½	66	45½
3½, 4 in.	....	....	66	45½
4½, 5, 6 in.	....	....	63	42½
7, 8 in.	....	....	60	37½

Wrought Nipples.	
4 in. and under	77½%
4½ in. and larger	72½%
4 in. and under, running thread.	57½%
Standard Couplings.	
4 in. and under	60%
4½ in. and larger	40%

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws, 60 &	10%
Sq. Head Set Screws 65 &	10%
Rd. & Fil. Head Cap Screws	45%
Flat & But. Head Cap Screws	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in. N.	70%
Semi-Fin. Nuts up to 1 in.	70%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

METALS.

	Montreal.	Toronto.
Lake copper, carload	$20 00	$19 50
Electrolytic copper	20 00	19 25
Castings, copper	19 75	19 00
Tin	37 00	38 00
Spelter	18 00	18 00
Lead	6 15	6 25
Antimony	35 00	35 00
Aluminum	52 00	55 00

Prices per 100 lbs.

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh	$24 50
Openhearth bilets, Pittsburgh	25 00
Forging billets, Pittsburgh	33 00
Wire rods, Pitsburgh	31 00

NAILS AND SPIKES.

Standard steel wire nails, base	$2 40	$2 35
Cut nails	2 50	2 70
Miscellaneous wire nails	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	70-10
Stove bolts	80
Plate washers	40
Machine bolts, ⅜ and less	65-10
Machine bolts, 7-16 and over	57½
Blank bolts	60
Bolt ends	57½
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes	4c per lb. off
Nuts, hexagon, all sizes	4½c per lb. off
Iron rivets	72½ per cent.
Boiler rivets, base, ¾-in. and larger	$3.75
Structural rivets, as above	3.75
Wood screws, flathead, bright	85, 10, 7½, 10 p.c. off
Wood screws, flathead, Brass	75 p.c. off
Wood screws, flathead, Bronze	70 p.c. off

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong. Sizes Ins.	Price per ft.	D. Ex. Strong. Size Ins.	Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	....
7 in	2.38	7 in	3.81	....	....
8 in	2.50	8 in	4.34	....	....
8 in	2.88	9 in	4.90	....	....
9 in	3.45	10 in	5.48	....	....
10 in	3.20	....	....	....	....
10 in	3.50	....	....	....	....
10 in	4.12	....	....	....	....

COKE AND COAL.

Solvay Foundry Coke	$5.75
Connellsville Foundry Coke	5.00
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

COLD DRAWN STEEL SHAFTING.

At mill	40%
At warehouse	35%

Discounts off new list. Warehouse price at Montreal and Toronto.

MISCELLANEOUS.

Solder, half-and-half	0.22½
Putty, 100-lb. drums	2.70
Red dry lead, 100-lb. kegs, per cwt.	9.65
Glue, French medal, per lb.	0.18
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.18
Benzine, single bbls., per gal.	0.18
Pure turpentine, single bbls.	0.64
Linseed oil, raw, single bbls.	0.74
Linseed oil, boiled, single bbls.	0.77
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Lead wool, per lb.	0.10
Pure Manila rope	0.16
Transmission rope, Manila	0.20
Drilling cables, Manila	0.17
Lard oil, per gal.	0.73
Union thread cutting oil	0.60
Imperial quenching oil	0.35

POLISHED DRILL ROD.

Discount off list. Montreal and Toronto 40%

PROOF COIL CHAIN.

¼ inch	$8.00
5-16 inch	5.35
⅜ inch	4.60
7-16 inch	4.30
½ inch	4.05
9-16 inch	4.05
⅝ inch	3.90
¾ inch	3.85
⅞ inch	3.65
1 inch	3.45

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	60
Carbon over 1½ in.	25
High Speed	
Blacksmith	60
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Centre	25
Pipe Reamers	80

Discounts off standard list.

IRON PIPE FITTINGS.

Canadian malleable, A, 25 per cent.; B and C, 35 per cent.; cast iron, 60; standard bushings, 60 per cent.; headers, 60; flanged unions, 60; malleable bushings, 60; nipples, 75; malleable, lipped unions, 65.

TAPES.

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3.50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$3 00	$2 75
Canada plates, dull, 52 sheets	3 15	3 15
Canada Plates, all bright	4 75	4 50
Apollo brand, 10¾ oz. galvanized	5 75	5 60
Queen's Head, 28 B.W.G.	6 00	5 95
Fleur-de-Lis, 28 B. W. G.	5 75	5 75
Gorbal's Best, No. 28	6 00	6 00
Viking metal, No. 28	5 25	5 25
Colborne Crown, No. 28	5 70	5 80
Premier No. 28	5 10	5 00

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$13 00	.....
1¼ in.	13 00	.....
1½ in.	13 00	.....
1¾ in.	13 00	.....
2 in.	12 50	8 75
2¼ in.	14 25	10 50
2½ in.	15 00	11 15
3 in.	19 25	12 10
3½ in.	22 00	14 15
4 in.	27 00	18 00

Prices per 100 feet, Montreal and Toronto.

WASTE.

WHITE.	Cents per lb.
XXX Extra	0 11
X Grand	0 10½
XLCR	0 09¾
X Empire	0 09
X Press	0 08¼
COLORED.	
Lion	0 07½
Standard	0 06¾
Popular	0 06
Keen	0 05½
WOOL PACKING.	
Arrow	0 16
Axle	0 11
Anvil	0 08
Anchor	0 07
WASHED WIPERS.	
Select White	0 08½
Mixed Colored	0 06¼
Dark Colored	0 05¼

This list subject to trade discount for quantity.

BELTING RUBBER.

Standard	50%
Best grades	30%

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50%
Standard	50 & 10%
Cut leather lacing, No. 1	$1.20
Leather in sides	1.10

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	$9.00
¼ in.	6.25
5-16 in.	4.65
⅜ in.	4.00
7-16 in.	4.00
½ in.	4.00

Prices per 100 lbs.

PLATING CHEMICALS.

Acid, boracic	$ .15
Acid, hydrochloric	.05
Acid, hydrofluoric	.06
Acid, Nitric	.10
Acid, sulphuric	.05
Ammonia, aqua	.08
Ammonium carbonate	.15
Ammonium chloride	.11
Ammonium hydrosulphuret	.35
Ammonium sulphate	.07
Arsenic, white	.10
Copper sulphate	.10
Cobalt Sulphate	.50
Iron perchloride	.20
Lead acetate	.16
Nickel ammonium sulphate	.10
Nickel carbonate	.50
Nickel sulphate	.17
Potassium carbonate	.40
Potassium sulphide	.30
Silver chloride (per oz.)	.65
Silver nitrate (per oz.)	.45
Sodium bisulphite	.10
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.35
Sodium hydrate	.04
Sodium hyposulphite (per 100 lbs.)	3.00
Sodium phosphate	.14
Tin chloride	.45
Zinc chloride	.20
Zinc sulphate	.08

Prices Per Lb. Unless Otherwise Stated.

ANODES.

Nickel	.47 to .52
Cobalt	1.75 to 2.00
Copper	.22 to .25
Tin	.45 to .50
Silver	.55 to .60
Zinc	.22 to .25

Prices Per Lb.

PLATING SUPPLIES.

Polishing wheels, felt	1.50 to 1.75
Polishing wheels, bullneck	.80
Emery in kegs	.4½ to .06
Pumice, ground	.05
Emery glue	.15 to .20
Tripoli composition	.04 to .06
Crocus composition	.04 to .06
Emery composition	.05 to .07
Rouge, silver	.25 to .50
Rouge, nickel and brass	.15 to .25

Prices Per Lb.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., Oct. 9, 1915.—The end of the first week in October sees the demand for steel bars and billets still on the increase; in fact, indications point to a still greater demand for billets suitable for the production of larger shells. Several large concerns have been discussing renewals of foreign orders, bids for 6-in., 8-in. and 9.2-in. shells being also under consideration. In the meantime it is altogether likely that further orders for the smaller sized shells will continue to be placed.

It is expected that in a short time the Shell Committee wil be reorganized and enlarged and with the assistance of Sir Frederick Donaldson, who is on his way here from England, an added impetus and activity will be given to the work. It is possible that within a short time the establishment of a large central ordnance factory will be given serious consideration, and if decided upon would eventually come under the direction of the Canadian Government.

Steel

High tension operation at our steel mills still prevails. In some instances steel producers are forced to turn down orders, being unable to make deliveries within a reasonable time. As usual, the demand for rounds and billets for war munitions predominates. Quotations for plates, shapes and bars are irregular, owing to uncertainty of delivery.

Metals

Quotations on the various metals are still holding firm and little change is to be noted in this week's prices. Tin, however, shows a decline of 2 cents per pound.

Machine Tools and Supplies

The condition of the machinery trade continues to keep dealers of uncertain mind in the matter of delivery, although appearances point to more favorable immediate outlook in the latter respect. The demand for supplies continues brisk.

Toronto, Ont., Oct. 12.—Trade conditions continue to gradually improve and indications point to further increases in the export trade of the Dominion. This is an encouraging feature as the favorable trade balance which has resulted will benefit the country considerably and put business generally on a more stable basis. The development of the export business is of course due to the large orders for war equipment, and there is every reason to believe that there will be a steady stream of these orders for some time to come. The result of the war business will mean general increased prosperity and an improvement in economic conditions.

As regards domestic trade, business is quieter, and, owing to prevailing conditions, few new enterprises are being started except for the manufacture of munitions. In this regard developments are expected in the near future, as it is understood that tentative inquiries are being considered for the manufacture of 60 pdr. and 180 pdr. shells. The making of artillery is being considered, but nothing has developed in this regard up to the present. That developments in the shell industry are promised is indicated by the announcement that two experts from England will assist the Shell Committee as technical advisers.

Steel Market

The probability of 60 and 180 pdr. shells being made in Canada will further stimulate the steel trade. The demand for steel for munitions is steadily increasing and the mills are working to capacity. The market for bars is very firm and an advance may be expected any time. Owing to the increased cost of raw material, prices of cold drawn steel shafting have advanced, the discount off list being 5 per cent. lower. Steel boiler tubes have advanced, the new quotations ranging from $1 to $2 higher per 100 feet, according to size. Wire rods are higher, being quoted at $31 Pittsburg.

Galvanized sheets continue irregular, the tendency being towards lower prices, although it is hardly probable that the low levels will be maintained. The shortage of semi-finished steel is a problem that galvanized sheet manufacturers will have to face, and although spelter is lower than it was some time ago, the price is still too high to be attractive to consumers. Painted sheets are being used instead of the galvanized product which has affected the market for the latter to a considerable extent. The revised prices for sheets are given in the selected market quotations.

There is an extraordinary demand for nearly all kinds of steel products in the States. Some of the larger mills are reported to be turning down nearly as much business as they are accepting, being unable to make the deliveries wanted. A tremendous demand for steel bars for shells continues and inquiries aggregate an enormous tonnage, the market being practically sold out for this year. Prices are advancing and bars, plates and shapes are now quoted at $1.40 Pittsburg.

Pig Iron

The market for foundry iron is still very quiet, but the demand for steel making pig iron is increasing. The market for standard low phosphorous iron is buoyant and there is an increased demand for this grade in Canada; a considerable tonnage being imported from the States. Quotations are firm, but unchanged.

Old Material

The market is weaker for copper and brass, and prices are slightly lower. Heavy melting steel and wrought iron are stronger on good demand and prices have advanced 50c per ton, lead and zinc are quiet and prices unchanged. Prices are given in the current quotations.

Machine Tools

The probability of orders being placed for larger shells has stimulated the market. Tentative enquiries are being sent out for larger lathes than have hitherto been used. The shells are of the high explosive type and range from 6 in. diameter upwards. Lathes of 24 in and 30 in. swing will probably be required for the work. Large orders for this equipment have already been placed with builders in the States by British, French and Italian agents. It is therefore possible that some difficulty will be experienced now in obtaining a sufficient num-

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EQUIPMENT FOR AUSTRALIAN RAILWAYS.

Tender forms, specifications and drawings have been forwarded by Commissioner D. H. Ross, Melbourne, for equipment required by the Victorian and Queensland Government Railways. These tender forms will be open to the inspection of Canadian manufacturers when received at the Department of Trade and Commerce, Ottawa (refer File No. 1435). Particulars of the requirements, together with the date on which the tenders close at Melbourne are briefly outlined thus:—

Victorian Railways.

No. 29,410. November 24.—2 duplex boiler feed pumps as specified.

No. 29,421. November 24.—750 sq. yds. compressed felt as specified.

Queensland Railways.

Tenders close at the office of the Queensland Railways, Brisbane, on November 2, 1915, for 10—30,000 gallons conical wrought iron tanks.

The departure of mails from Vancouver are indicated thus:

From Vancouver, October 27, due at Melbourne on November 20.

ber of heavy lathes for immediate delivery. There is still a good demand for second-hand equipment and increased activity is anticipated for lathes of this class.

Supplies

Business continues brisk and prices have an upward tendency. There has been an advance of approximately 5 per cent. in bolts and nuts. Cap and set screws are also higher. Linseed oil has again advanced 2c per gallon and is now quoted at 74c for raw and 77c for boiled oil. Revised prices are given in the selected market quotations.

Metals

The market generally is steady and there is nothing of particular interest to report. There are no price changes to note this week, the markets being dull and featureless. The demand for metals for munitions continues brisk, but ordinary business is comparatively quiet.

Tin—Both London and New York markets are dull and unchanged. There is very little business doing, both buyers and sellers awaiting developments as there is a possibility of an export duty being levied on tin by the British Government. Quotations are unchanged at 38c per pound.

Copper—The market it quiet and unchanged, but in good condition. Producers generally are satisfied with the situation, and while the demand is dull at present, increased activity is expected in due course. Quotations are firm and unchanged at 19½c per pound.

Spelter—The market is dull and easy, with a lower tendency. The demand is light and consumers are not showing much interest. Quotations are unchanged at 18c per pound.

Lead—The market is very steady, there being no change of any sort. This metal continues in good demand. There is an impression in the trade that no official change in price is likely in the near future. Lead is quoted locally at 6¼c per pound.

Antimony—The situation is unchanged and market dull. Quotations are nominal at 35c per pound.

Aluminum—There is nothing of particular importance to note in this market. Supplies are still very scarce and quotations nominal at 55c per pound.

C.P.R. ANNUAL METING

THE thirty-fourth annual meeting of the Canadian Pacific Railway Co. was held in Montreal on Oct. 6, the president, Sir Thomas Shaughnessy, in the chair. The business dealt with consisted of the presentation of the annual report, the adoption of the annual financial statement, and the election of officers. Directors re-elected were: R. B. Angus, Montreal, Sir Herbert S. Holt, Montreal, and Sir Edmund Osler, of Toronto. Colonel F. G. Meighen, of Montreal, was elected to fill the vacancy left on the directorate by the death of Sir William Van Horne. The shareholders also adopted a resolution empowering the absorption of the Allan Line Steamship Co.

In the course of his address Sir Thomas Shaughnessy remarked that the company's annual statement was in some respects the most unsatisfactory submitted in a number of years. The shrinkage of $31,000,000 in the gross earnings was in excess of the entire gross earnings for 1901. Notwithstanding this falling off in revenue, the regular dividends had been earned, evidence of the foresight of the company in making such expenditure in the past ten or twelve years as to enable it to make a saving in the working expenses and offset the loss.

The physical condition of the company's property had never been better, while traffic had been handled more expeditiously and economically. He thought they could look forward to the future with buoyant confidence, as everything pointed to a marked improvement in the company's revenue during the current fiscal year. The country had been blessed with a most bountiful harvest and the field crops harvested in the four provinces west of Lake Superior will yield per capita to their civil population more than twice as much money as the rural population of the eight States directly south of them received per capita in 1914.

The company's land sales were 77,000 acres in the last three months, compared with 41,000 in the same months last year. Mining and lumber activity in the West indicated a partial restoration of confidence. It was to be hoped that in anticipation of the end of the war an organization would be perfected for unity of action between the Dominion and Provincial Governments and the important business interests of the country in regard to the immigration of agriculturists and the comprehensive development of the natural resources of Canada.

Sir Thomas said that, until the money market improved, no especial effort would be made to dispose of any portion of the four per cent. consolidated debenture stock, amounting to $40,000,000, and representing advances made by the company's treasury for additional mileage, as there was on hand sufficient money to meet all requirements for a considerable period.

CANADIAN GOVERNMENT PURCHASING COMMISSION

The following gentlemen constitute the Commission appointed to make all purchases under the Dominion $100,000,000 war appropriation:—George F. Galt, Winnipeg; Hormidas Laporte, Montreal; A. E. Kemp, Toronto. Thomas Hilliard is secretary, and the commission headquarters are at Ottawa.

ALLIES PURCHASING AGENTS

The Trade and Commerce Department, Ottawa, has published the following list of purchasing agents for military purposes for the allied Governments:

International Purchasing Commission, India House, Kingsway, London, Eng.

French.—Hudson Bay Co., 56 McGill Street, Montreal; Captain Lafoulloux, Hotel Brevort, New York; Direction de l'Intendence Ministere de la Guerre, Bordeaux, France; M. De la Chaume, 28 Broadway, Westminster, London.

Russian.—Messrs. S. Ruperti and Alexsieff, care Military Attache, Russian Embassy, Washington, D.C.

DOMINION STEEL CORPORATION

SIXTEEN months ago the Dominion Steel Corporation had pressing obligations of $5,500,000. By the close of the current year, according to a statement of one of the directors, this debt will be practically all wiped out. Advances to banks will be repaid, the notes due November 1, amounting to $1,500,000, will be met, and the company expects to be in a position to pay dividends after the close of the year. The following table shows the company's position:

Obligations 18 months ago:	
Notes	$1,500,000
Due banks	4,000,000
Total obligations	$5,500,000
Obligations July 31, 1915:	
Notes	$1,500,000
Due banks	2,300,000
Total obligations	$3,800,000
Account credit company in banks	1,400,000
	$2,400,000

This debt of $2,400,000 will be wiped out by actual and estimated earnings of the company during the last five months of the current year. Export trade comprises the bulk of operations. Orders have been heavy for bars, billets, wire and nails, and contracts for toluol have

proved exceptionally profitable. The coal trade has been the best in the history of the company. In addition to this, the company is now working on a special Government contract amounting to $1,500,000.

NOVA SCOTIA STEEL & COAL CO.

AT the meeting of the directors of the Nova Scotia Steel & Coal Co., held at New Glasgow, N.S., on September 29, the general manager submitted a statement relative to the business of the company which was considered most satisfactory. The output of shells for September was the largest of any month since the manufacture of munitions was begun, being 40 per cent. over that of August. It was reported that the orders on hand would keep the company at the present high rate of production for at least six months, and that negotiations for others were in progress.

Although it is understood that important matters relative to the financing of the company were taken up by the directors, no statement could be obtained. At the conclusion of the meeting it was stated, regarding war orders, that, in addition to other large orders which are being negotiated for, a large car contract was expected to be signed shortly.

The meeting was attended by Lieut.-Col. Thomas Cantley, president; W. D. Ross, vice-president; the Hon. J. D. McGregor, J. Walter Allison, George S. Campbell, W. H. Chase, Frank Stanfield, R. F. Chambers, and James C. McGregor. In the morning the directors made a tour of the company's plant.

Woodstock, Ont.—The ratepayers are asking the council to compel the Woodstock Gas Light Co. to supply purified gas. It is suggested that purifiers be installed by the company.

CANADA STEAMSHIPS

THE Canada Steamship Lines is bringing several of the grain boats which went into Atlantic service in the spring back to the Great Lakes for the movement of the Western harvest. The company reports that it will be in a position to handle the usual volume of grain before the close of navigation, and the statement has been heard that the boats of this concern alone could probably handle a sufficient volume of the Western output to keep the Montreal elevators busy.

The tourist season on the lakes is now about over. It is understood that the passenger traffic this season has been very light and not up to what had been hoped for, even though transportation officials did not place much faith in the campaign to bring American sightseers to the north to make up for the elimination of European attractions.

Intensified Production in a Shrapnel Shell Factory

Staff Article

Prior to the advent of shell making, the products of modern machine tool builders seemed to have reached finality, not only in refinement of design and accuracy of work, but also in quantity of production. The conditions pertaining to shell work have afforded progressive manufacturers welcome opportunity for exercising individual initiative in machine design. The examples described are as interesting as their results are commendable.

SIX months ago the plant referred to in this article was completing shells at a rate of 800 per day. This was considered good, as the result of several months' work on shells.

To-day this plant completes 2,700 shells per day with practically the same number of men and machines. Considered in the light of other manufacturers' progress, the previous methods and equipment were well advanced, and any shell maker would not have offered himself for criticism had he decided at that time to leave well alone, and insure the continuous operation of the plant under the then existent conditions.

While the arrangement of the plant, generally speaking, is more or less the same as six months ago, certain changes in methods, machines, and equipment have more than trebled the output.

The changes in methods resulted in the saving of time by combining certain operations with others, either before or after. Other instances arose where it was found better to move the work instead of the tool, as in waving, for example.

Changes in machines refer to at least two specific instances where castings used in the regular business of the company were utilized in a manner very different from what they were originally intended to be. Other cases refer more to improvement in fixtures and operating devices. The principal change in equipment refers to the substitution of a chute system in place of transfer trucks.

Methods

A careful study of the requirements showed that the contour of the nose could be done as part of the rough turning on boring mills instead of as a separate subsequent operation. As performed on a "Bullard" vertical turret lathe, the rough turning is an excellent example of speed and accuracy on the part of man and machine. The square tool box on the side carriage has two turning tools, one roughing A and one sizing B. The cross slide carriage has a radius tool C, which is also used for facing across the base. The turning tool on side carriage is started at the base of the shell, which is driven on to a grooved arbor. While it is travelling downwards, the cross slide carriage is run down by rapid power and set for cleaning up the base, which has been previously roughed in a miller (see Fig. 4). By the time the base is cleaned up and the radius formed (see Fig. 1), the turning tool A has reached the point on the shell where the taper starts. The operator now feeds it out gradually by hand, producing a taper of sufficient accuracy to meet the requirements for nosing later.

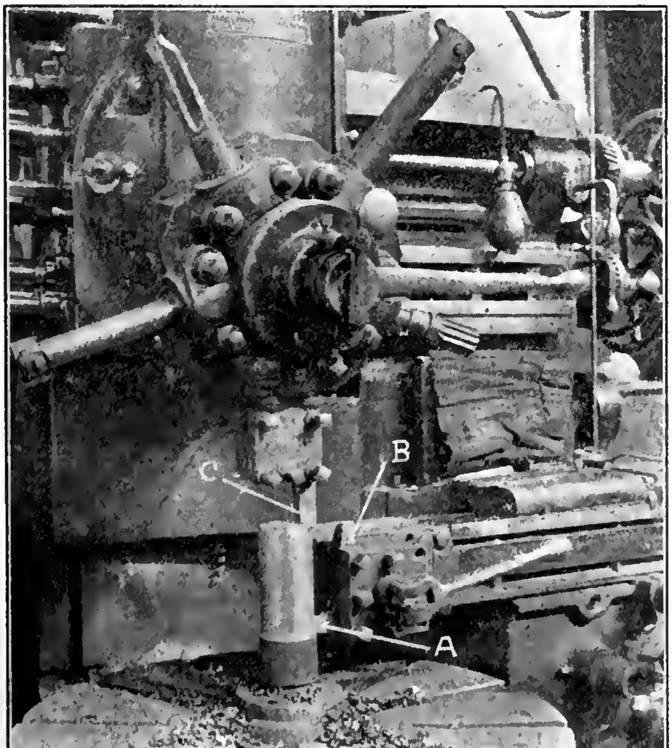


FIG. 1. ROUGH TURNING SHELL FORGING ON "BULLARD" VERTICAL TURRET LATHE.

Rapid travel now takes the tool A up to the base of the shell, when a quarter-

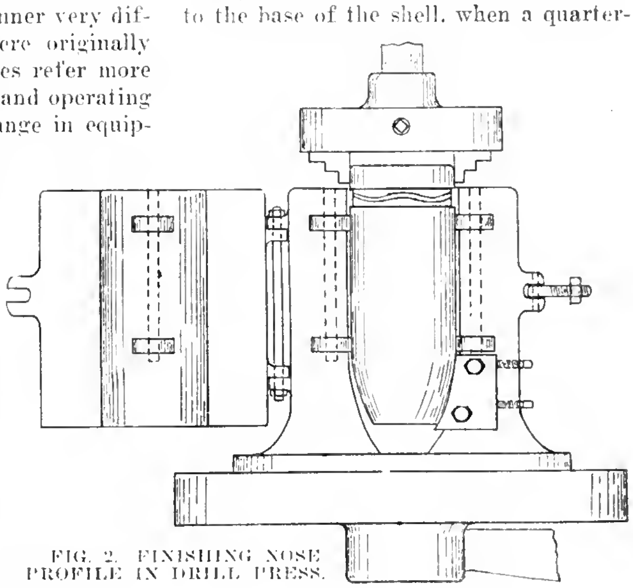


FIG. 2. FINISHING NOSE PROFILE IN DRILL PRESS.

turn of the tool box brings tool B into position, when a finish cut is taken across the groove. The operation of rough turning is now completed, the groove being machined afterward.

The method adopted for waving is quite a departure from recognized practice, although the variety of methods already in use by shell makers are quite numerous. A helical spring and ball thrust bearing on the tail end of the spindle maintain the spindle in its normal position. The shell is gripped base end in the chuck, a pipe centre truing up nose from the inside. A rapid movement of the tailstock spindle is obtained by hand lever. The pipe centre slides inside of spindle and is backed by a helical spring. The undercutting tool in front of the work is of the solid type which is fed straight in to the proper depth and then moved sideways. This tool is operated first, the sidewise movement of the carriage being controlled by stops. A wedge like plate is interposed between the left hand stop and the end of the carriage. This plate may be swung round on its hinge and allows of accurate adjustment being made when setting the tool.

Reversed Waving

As soon as the undercut is machined, the tool is withdrawn, the carriage held

towards one side against the stop, and with the spindle reversed, a hand lever is pressed which forces a roller between the end of the front spindle bearing and a cam plate on the back of the chuck. The springs A and B are now in action, and the shell is moved sideways in front of the waving tool which is back of the shell, and which is fed in by hand in the usual manner.

This method of waving provides a very smooth running machine which turns out smooth waves with no chattering, and runs at a high speed. The use of springs instead of weights is preferable because of the absence of inertia and momentum which cause greater wear on the cam.

The idea of holding the tool steady with the carriage in a stationary position against a stop eliminates all chatter such as sometimes occurs on reversal with reciprocating carriages on tool holders.

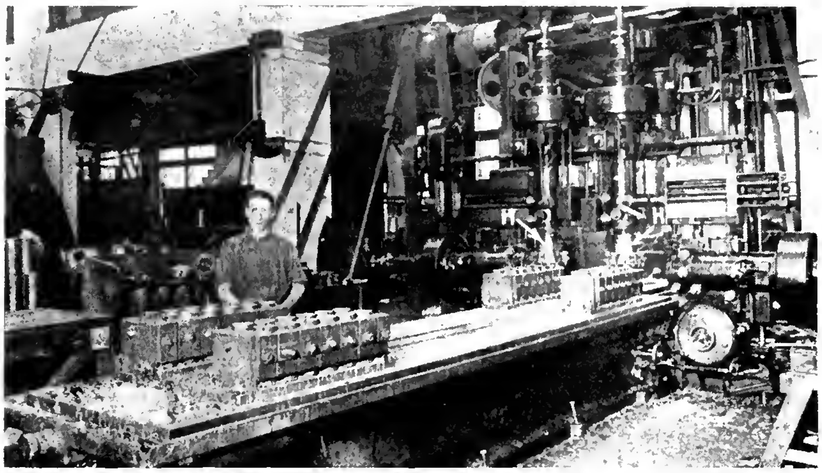


FIG. 3. ROUGH MACHINING BASES IN HORIZONTAL MILLING MACHINE.

Machines

It has been the experience of many shell makers that the limiting factor of grinding success is the necessity of truing up the curved portion of the wheel A skilled operator using a piece of carborundum crystal has been known to get almost sixty shells ground without bringing the truing up device into play and using the diamond. Average operators run about half, but the occasional loss of diamonds is an objectionable feature. This firm, like others, has accordingly discarded the grinder for the nose profile, retaining it for the cylindrical portion only. After nosing, the shell is rough turned to profile with a flat forming tool, and then ground on the parallel portion, after which it is chucked by the base in a drilling machine, nose down, and forced down into a fixture which has three pairs of guiding rollers, and is provided with a flat forming tool for finish scraping the nose to shape. One pair of the rollers is hinged on a gate which opens to allow the shell to enter and leave the fixture. The action of the fixture is identically that of a huge pencil sharpener (see Fig. 2).

A large 4-spindle "Ingersoll" milling machine has been employed for rough machining the bases, and until recently it operated with the two vertical heads only; the side heads remaining idle as shown in photograph, Fig. 3. As will be noticed here, the shells are held in fixtures each holding 12 shells, and arranged in pairs at each end of the table so that in machining a lot of 24 shells, the table had to travel sufficiently far to pass six shells across the cutter.

A Striking Comparison

Reference to Fig. 4 will show clearly how the machine was utilized to its full capacity. The fixtures at either end of the table were redesigned so as to each hold four groups of seven shells each. These are arranged so that the cutter heads come into action on their own group of shells simultaneously, the vertical heads projecting in advance of the side heads.

The difference in the methods of clamping the work in Figs. 3 and 4 call for special mention. In Fig. 3 the original fixtures had 24 nuts which had to be loosened and tightened each travel of the table. The present fixtures require 12 set screws only to be adjusted.

With a table travel of six shell diameters plus clearance, this machine formerly completed 24 pieces. With a table travel of four shell diameters without clearance this machine now completes 28 shells. Neglecting clearance spaces in fixtures this represents an increase in rate of output of approximately 75 per cent.

Machine Tools Extraordinary

If any self-respecting machine tool builder were to be told that a gas engine frame with a few fixtures added made a first class boring machine, he would have serious doubts regarding the sanity of his informant. Fig. 5 is a sketch of such a machine in actual use. It was constructed after trials with a converted bolt cutter proved successful. The cylinder A forms a substantial support for the cutter spindle B, a suitable bearing being mounted at each end. In the crankshaft supports is mounted a yoke C, the upper and lower portions of which support two fixed slide rods D. One end of these slide rods is fastened to the cylinder head, and the other end extends to the end of the bedplate where a yoke E is mounted, in the centre of which is mounted the feed gear.

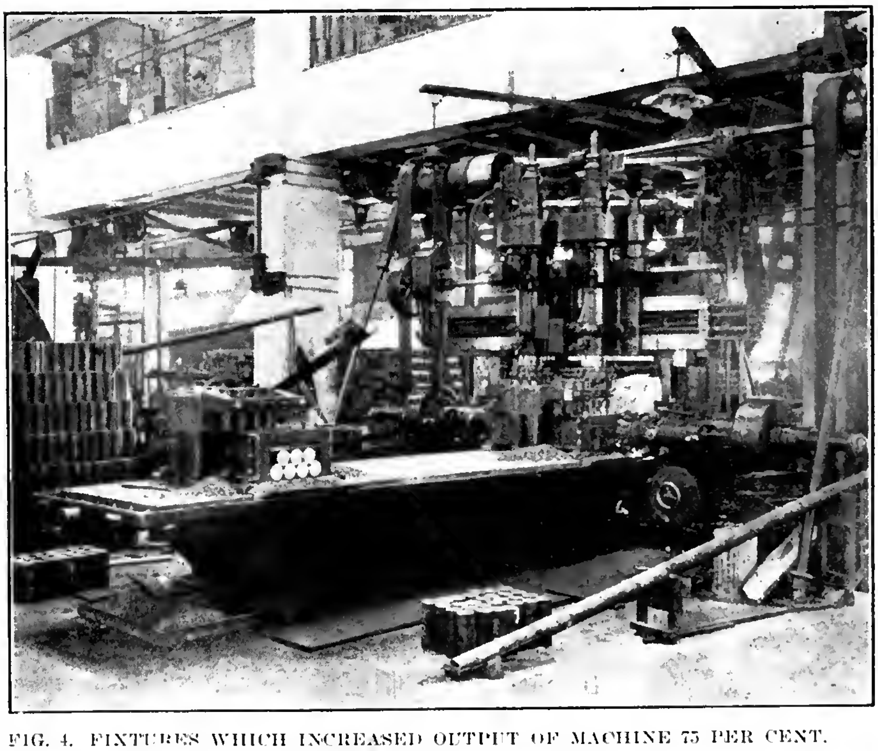


FIG. 4. FIXTURES WHICH INCREASED OUTPUT OF MACHINE 75 PER CENT.

Between the cylinder head and the yoke C a sliding chuck G, is mounted on the slide rods. Rapid traverse of this chuck along the slide rods is obtained by means of a link and handwheel H.

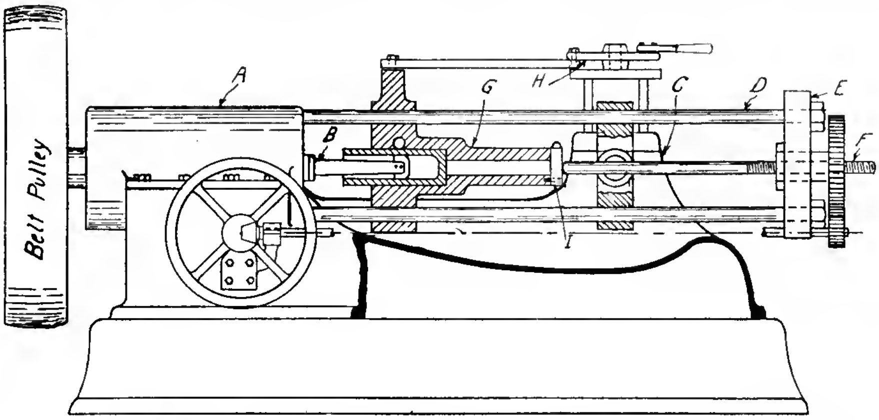


FIG. 5. SHELL BORING MACHINE BUILT FROM GASOLINE ENGINE PARTS.

The chuck G, is made a close fit for the shell which is tightened by one blow of a hammer on a taper pin. When the chuck G, is moved away from the cutter bar B to let the shell into position, the plate I is swung clear, allowing the body of the chuck to telescope over feed spindle F.

The shell is now slipped over the cutter bar B, the chuck G, moved over the shell and taper pin tightened. Plate I is swung back into line with spindle F, and boring commenced, on completion of which the operations are reversed, the shell remaining on the cutter bar while the chuck is drawn away.

Experiments with cutters have shown the feasibility of doing this operation with one cutter only, the extra output more than off-setting upkeep of cutters. Owing to the lack of a large enough pulley, this machine takes 56 seconds per shell for boring to gauge, but when properly equipped and operated, it is expected to surpass even that satisfactory performance.

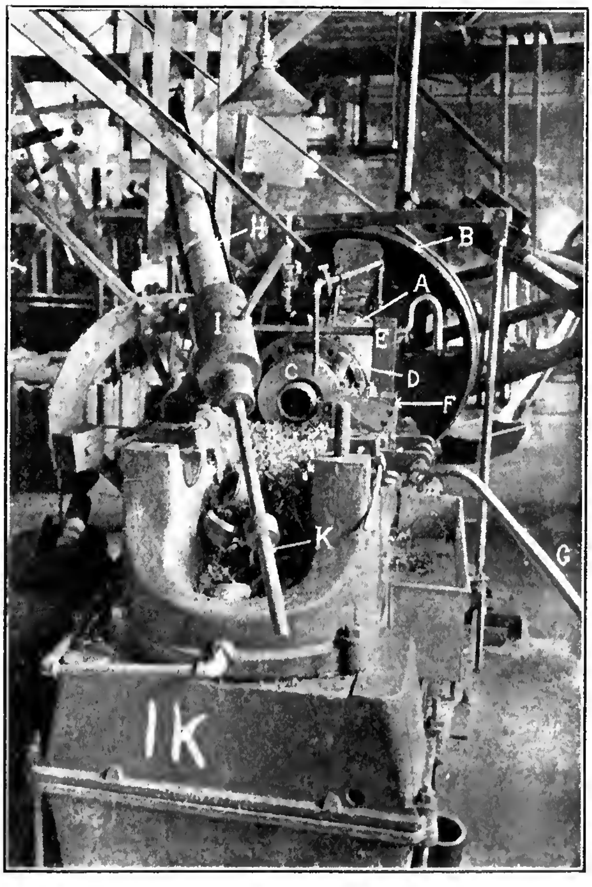


FIG. 6. TRANSFORMED GAS ENGINE DOING DUTY AS CUTTING-OFF MACHINE

Another example of all precedent being thrown aside is illustrated in Fig. 6, which shows a cutting off machine built from a gasoline engine bed and cylinder on somewhat the same lines as the boring machine just described. The hollow spindle extends through the cylinder casting A, being suitably mounted on bearings at each end. The rear end carries the large belt pulley B, while chuck C is mounted on the front end of the spindle. Chuck C is solid, and is bored an easy fit for the rough forgings, which are instantly fastened in position by a blow on the large end of the massive taper pin D. In practice the pin D is stopped in a horizontal position, so as to be conveniently operated by hammer E, which has a head at either end, one for tightening, and one for slackening.

A cross slide is fitted with a tool box F, which carries the tool proper, and is operated by elevating the hand lever G. Shells are received via the chute H, the lowest shell being contained in loader I, which is hinged so as to swing into line in front of the chuck. During this movement the shells in the chute are held back by retainer J. Rod K is used to eject the shell from the loader I into the chuck, the collar on the rod locating the shell. A smart blow or two with the hammer E securely wedges the shell afte which cutting off is merely a matter of belt power and tool strength, both of which are ample, accomplishing the complete operation in an incredibly short space of time.

Each additional shell pushes the preceding one ahead of it until they drop out of the back end of the spindle where a chute with a registering device conveys them to their destination.

Trucks Eliminated

The mention of chutes brings forward what is perhaps the most interesting of the many interesting features in this plant. The duties of the chute system which has been installed here, are passive rather than active, yet its influence on the output in proportion to its cost, is perhaps, greater than any other portion of the plant.

Persons familiar with machine shops, know that a considerable amount of each man's time is spent lifting a job off a truck and putting it back when finished. In the case of shells, this time is apt to be unduly prolonged either through fatigue, or lack of interest, etc. If it is possible to avoid this slackness, and arrange a system whereby the shell is slipped right under the man's hand, where he can reach it without exertion, and which only requires the shell to be lifted to the height of the man's shoulder to start it on the next stage of its journey, then an amount of unproductive energy is conserved, and the time required, which formerly was an actual loss to employer and employee, is now spent in doing productive work, which under the bonus system in force at this factory, means just so much more money for the workman at the end of the pay.

The adoption of the system rendered necessary the establishment of inspection benches at certain points, where the work is received from a preceding group of machines, and is distributed through individual chutes to several machines in another group, which perform the necessary work, and if immediate inspection is required, return it by another series of chutes to the inspection bench. Where corrections have to be made, a "returns" chute is provided to each machine, making three chutes on occasion between inspection bench and each machine of a group.

Should inspection not be required, the operator does not return the shell to the inspection bench, but instead, sends it on by a chute to the machine which is to do the succeeding operation. In this manner the shells travel individually as each stage is completed.

Full advantage has been taken of the many time saving possi-

bilities of such a system, the adoption of which made it possible to immediately locate the cause of any slowing down in production. The whole plant now became one vast unit with each machine, or group of machines, as the case might be, having its output strictly limited to the number of shells sent on to it from the previous group. A choking or overflowing of the chutes indicates where a hold-up is taking place. and enables additional facilities to be provided as the minimum output is shifted around from one operation to another.

A considerable amount of time and labor was also saved by providing each chute with a counter which had suitable symbols marked on it, indicating nature of operation, etc. These counters were simply and cheaply made by using Veeder cyclometers with a large disc mounted on the spindle. The counter is mounted on the chute so that as the shell passes underneath, it revolves the disc a certain amount so that each shell keeps tally for itself. In the case of shells which are returned to a machine for correction, the shell is put in the chute ahead of the counter so as not to register twice.

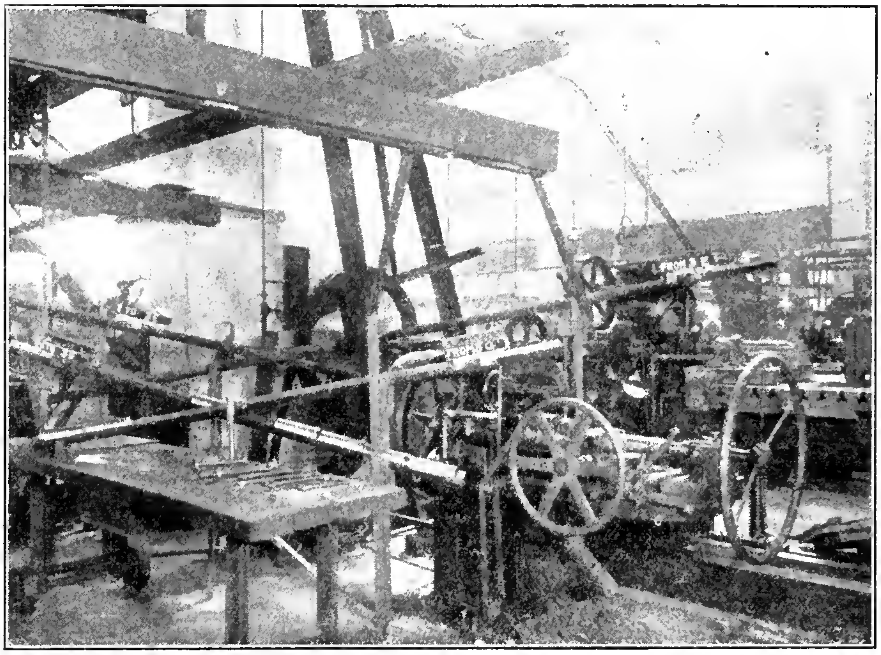


FIG. 7. CHUTE SYSTEM BETWEEN INSPECTION BENCH AND MACHINES.

Fig. 7 shows an inspection bench with chutes serving three boring machines, the small machine in the right foreground being a converted bolt cutter, which has rendered excellent service in shell boring. The counters can be seen on the upper end of each chute at the machines. Fig. 8 gives a good idea of the labor saved in carrying shells from the banding press to the band turning machines. These machines are small turret lathes fitted with automatic collet chuck coupled up by link motion to the turret slide. The movement of the turret tightens the chuck and takes a rough cut off the band at one operation.

Finishing and sizing tools are mounted on small cross slide. With copper of average softness, one of these machines can finish a band complete in 27 seconds.

A great amount of labor in handling, counting and trucking shells is thus dispensed with, and records are kept up to the hour or minute if desired.

Premium and Bonus Systems

The greatly increased output in this plant is largely due to the efforts and ability of the company's executives in providing labor saving devices, improving machining methods, rebuilding machines, developing chute systems, and otherwise keeping up every detail of the work to the last notch of efficiency. Such efforts by the company would have yielded much less gratifying returns had it neglected that all important factor of modern commercial success, i.e., the human element.

Some concerns have attained considerable prominence, and achieved large financial success while maintaining an attitude of decided indifference towards employees' earnings. The possession of valuable patent rights and large profits accruing therefrom have in a few individual instances enabled the employers

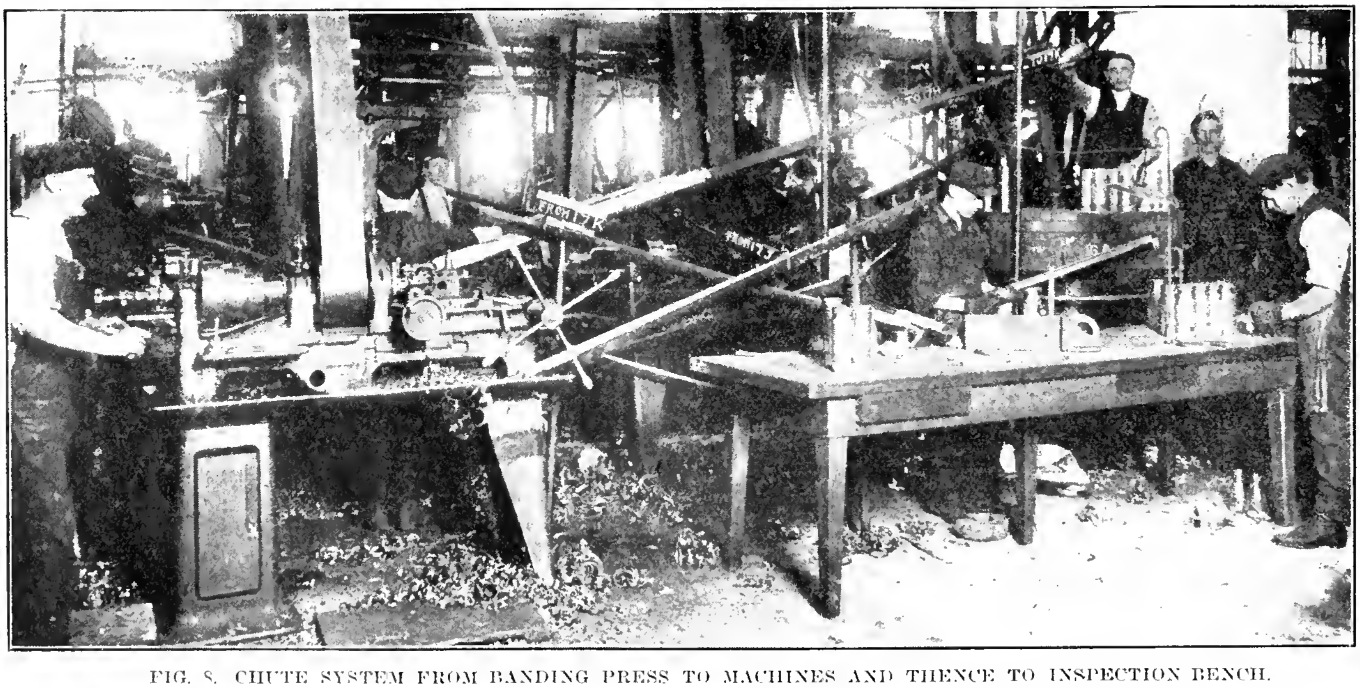


FIG. 8. CHUTE SYSTEM FROM BANDING PRESS TO MACHINES AND THENCE TO INSPECTION BENCH.

to ignore altogether the just claims of the actual producers.

The capable manner in which this concern approached the problem of securing the men's whole-hearted co-operation has met with all the success to which it is entitled. It is safe to say that the attitude and enthusiasm of the men toward the work being done, is only equalled by the sincerity of their regard for the frank, open-handed manner in which the company has dealt with them.

This desirable condition is due to the adoption and faithful carrying out of a combined premium and bonus system. All of the men who are engaged on machining, hardening, loading, etc., or producing in any form, are paid on the premium system. After careful study, a time limit was established for a certain operation, and except when a new method, process, tool, or other improvement is introduced, this limit is never changed. When the fortnightly earnings are made up on the basis of the number of hours worked, each man receives a premium payment equal to the value of half of the time saved over the limits set for the different operations. In this way every producer automatically becomes a partner in the business, the firm supplying machinery, work, material, power, etc., and sharing equally with each employee the profits which are directly due to his own individual effort.

A Factor of Success

The "human element" is always present in such affairs, and however great the success of the present instance, other cases might result in failure if this factor were not properly regarded. The chief point of this regard is a liberal basis for time limits. If a certain time limit yields a satisfactory cost for a certain operation, then the employer should constantly remember the all important fact that every dollar extra which a man earns as premium, also represents a dollar less cost to the company.

In addition to this premium system, a bonus system has been put into effect which applies to all non-productive labor. This covers tool-makers, stock-keepers, laborers, etc., and also the entire office force. This bonus is distributed on a percentage basis, and is based on the average daily output over a fortnightly pay roll period.

A bulletin board in a prominent position is kept posted with the latest output figures and the corresponding bonus, thus maintaining a state of active expectation which reflects itself in a steadily increasing output at less cost to the firm, and accompanied by proportionately higher wages for the men.

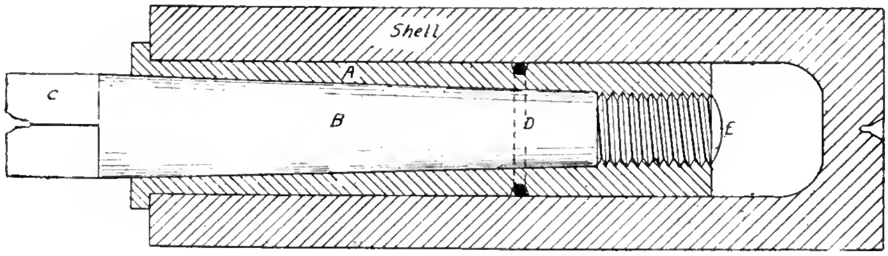
EXPANDING MANDREL FOR TURNING SHELLS

By J. A. Moffat

THE accompanying sketch illustrates an expanding mandrel used in turning shells where the bore is parallel. The sleeve A is turned about .010 smaller than the bore of the shell and is split in the centre to allow it to expand when the taper plug B is screwed in.

A round steel spring D holds the two pieces of the sleeve together. The end C of the plug fits into a square driver fastened to the face-plate of the lathe. The screw E is made standard pitch, which prevents the plug from pulling out when the sleeve expands.

In practice two mandrels are used. While one shell is being turned, its predecessor is being removed from the mandrel and another put in its place and made ready.



EXPANDING MANDREL FOR TURNING SHELLS.

MOLYBDENITE SAMPLES FROM NORTHERN QUE.

G. R. E. KENNEDY, of Sherbrooke, has returned from a trip into Northern Quebec, with some 50 lbs. of molybdenite specimens which have been sent to the Assay office for analysis. They were obtained by him and J. D. Kennedy, who investigated and successfully relocated claims formerly taken up and prospected by Capt. K. E. Kennedy, who had to abandon them on going to the front.

Remarkable rich samples were secured with nothing but a prospector's pick, in a granite and pegmatite formation, of which there is a large area, and covered by their claims.

There are only a few places in Canada where this somewhat rare mineral, molybdenite (sulphite of molybdenum) is found, and the world's production is very limited.

It is used in the manufacture of high speed steels armor plates, rifle and big gun barrels, etc., to which around 10 per cent. imparts the quality of taking a great heat without loss of temper. It is now in great demand by Great Britain and France. Before the war, it was worth around $400 per ton, for 90 per cent. concentrates. Late quotations are $3,300 up. It is substituted for and superior to tungsten.

The Kennedy Claims are splendidly situated for shipping and can be worked to great advantage by tunnel, which, with the fine showing of ore, give the property all the earmarks of a very valuable mine, despite the usual pockety nature of the few known deposits of molybdenum.

STEEL MAKING IN ELECTRIC FURNACES

THE making of steel in electric furnaces was the subject of several interesting addresses given before the Montreal Metallurgical Association at a meeting held on October 13 under the chairmanship of Dr. Alfred Stansfield. Attention was drawn to the fact that the making of steel by this process is about to be practised in Montreal. The meeting was opened by Dr. Stansfield, who spoke of the commercial possibilities of the electric furnace in steel foundries.

The chairman was followed by Mr. Davey, of the Canadian Brake-Shoe Co., who gave a detailed account of the furnaces in use at the Sherbrooke steel foundries of that company. These furnaces are four in number, each of 5,000 pounds metal capacity.

G. C. McKenzie, of Ottawa, representing the Mines Branch of the Department of Mines, told of the electric furnaces for making steel at Welland and Toronto. He referred also to the Moffatt-Irving process for the production of steel directly from Canadian ore, and explained that this process was about to be tested by the Government.

Mr. Evans, of Belleville, described the Evans-Stansfield process for making cold steel electrically from titaniferous magnetite ore.

A short account of steel making at the Longueuil plant of the Armstrong-Whitworth Co., which will shortly introduce the Heroult furnace for that purpose, was given by C. Bristol, and Mr. Green, of the same company, had with him some materials which he melted in the electric furnace in the McGill metallurgical laboratory. At the end of the meeting he poured the molten steel into two ingots .

Sheet Metal Elbows: Their Development and Laying Off

By J. W. Ross

In order to thoroughly understand the principles involved in the development of cylindrical and other forms, such as are met in sheet metal work, a considerable knowledge of geometry is desirable. Through the medium of these articles, the author places practical examples at the disposal of our readers, and the knowledge to be gained by a close and persistent study of the principles and methods employed will well repay the time spent.

THE fabrication of elbows forms a considerable part of sheet iron workers' practice. The various forms, cylindrical, oval and rectangular, will be herewith described, and the patterns developed for both heavy and light plate.

For the purpose of students' home practice, the measurements will be given in inches, so that the developments may be made on stiff paper. The patterns may be perforated at the located "rivet holes," by a punch similar to a tram conductor's transfer punch, which may be purchased at any 15-cent store. this punches a round hole. The patterns can then be connected together by common paper fasteners. This is good practice for the student in laying out the rivet holes, which will give him the necessary confidence when laying out on the plate.

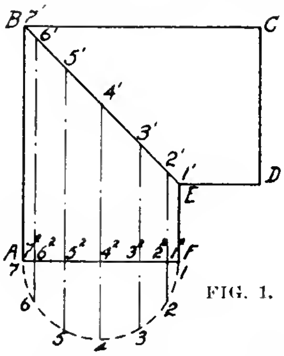


FIG. 1.

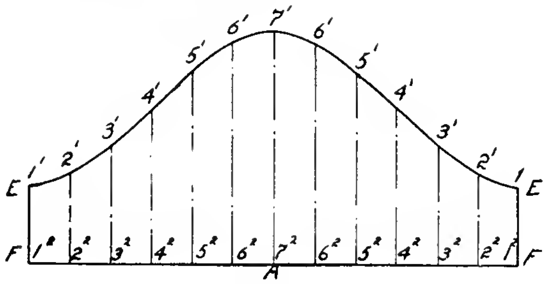


FIG. 2.

Cylindrical Elbows

Fig. 1 shows an ordinary two-piece 90-degree elbow which will be developed by the parallel line method.

Measure off AF, Fig. 1, equal to 1½ inches, at right angles to AF, draw AB and FE, making AB equal to 2¼ inches, and FE ¾ inch. BC is drawn parallel to AF, and equal in length to AB. CD is parallel to BA, and equal in length to AF. DE is drawn at right angles to CD and EF, and of the same length as EF. Connect the mitre line BE, which is at 45 degrees, to the lines BA and BC. Bisect AF, and with 4^2 as centre and 4^2 A as radius, describe the semi-circle A 4F, showing the half section view of the elbow. Divide this view into a suitable number of equal parts, in this case 6 parts are chosen. Each point is numbered in consecutive order. From these points draw lines parallel to the lines AB and EF, up to their insections with the mitre line BE, which are numberged in relation to the points on the half plan view.

As the elbow is made in two courses and of equal diameters, it will readily be seen that the mitre line as stated forms an angle of 45° degrees, therefore it will only be necessary to lay out one course, from which afterwards the other may be marked.

The neutral circumference of the elbow, or the stretchout as it is more generally termed, equals the neutral diameter multiplied by either 3 1/7 or 3.14, which equals $1.5 \times 3.14 = 4.71$ inches, or slightly under 4¾ inches. Measure off FAF, Fig. 2, equal to 4¾ inches. Bisect at 7^2 and erect the perpendicular 7^27^1. Divide 1^2 to 7^2 into the same number of equal spaces, as in Fig. 1 on the plan view; also divide 7^21^2 similarly, thus making 12 spaces in all. Erect perpendiculars on these points, which are, of course, at right angles to the line FAF, and parallel to the centre line AB. Set the dividers to the distance 7^27^1, Fig. 1; transfer this over to the corresponding number in Fig. 2. It will be noted the seam is located on the line 1^21^1, Fig. 1.

Reset the dividers in each case to the distances 6^26^1, 5^25^1, 4^24^1, 3^23^1, 2^22^1, 1^21^1, Fig. 1, and transfer over each distance to its allocated line in Fig. 2.

A smooth even curve drawn through these located points will define the mitre line, which is also the rivet line. Laps are to be added to the rivet mitre line, and also the rivet lines 1^21^1, Fig. 2, for the vertical seam.

As both courses are the same size, the connection at the mitre line, after the plate is rolled up, will necessitate one of the courses to be slightly opened out with a machine suitable for that purpose, or, in default, with a hammer, so that one course will fit over the other.

In tinsmith work suitable seaming allowances are made according to the style of seaming. Fig. 2 shows the pattern without any allowance for laps.

60-Degree Elbow

Fig. 3 shows the elevation and half-sectional views of a two-course cylindrical 60-degree elbow. Draw the line GLO, make OL equal to 1 1/16 inches, and the neutral diameter of the elbow GL equal to 1½ inches. With centre O and radius G, describe the arc GI. With the same radius and G as centre describe another arc to intersect arc GI at I. Connect I to O by a straight line.

The angle formed by GO and IO is 60 degrees. Bisect the arc GI at M, and through this point draw a straight line from O, extending to H. At right angles to GL draw the lines GH and LK to intersect the mitre line HK. Connect H to I and K to J. If carefully constructed the course GHKL will be equal to HIJK. Bisect GL at 4^0 and draw in the half-sectional view G4L. Divide this semi-circle into any number of equal parts, according to the exigencies of the work. Project these located points to the mitre line, as explained in Fig. 1.

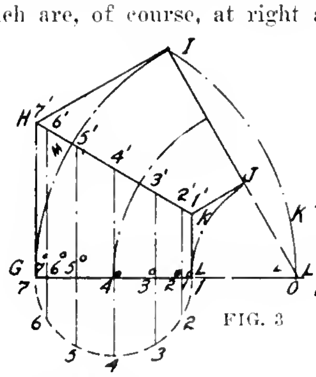


FIG. 3

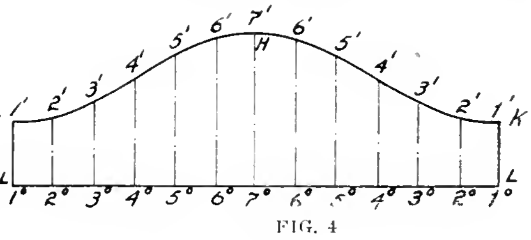


FIG. 4

The stretchout LGL, Fig. 4, equals 1½ times 3.14, which equals 4.71 inches, or slightly less than 4¾ inches. Bisect this line LGL at 7^0 and erect the perpendicular 7^07^1, thus locating the centre line

of the templet, and also defining the seam lines 1^01^1 and 1^01^1. Divide 1^07^0 and 7^07^0 each into the same number of equal spaces, as in Fig. 3. Erect perpendiculars parallel to the centre line 7^07^1 through the points thus located, also numbering each perpendicular in relation to the construction lines, as 1^01^1, 2^02^1, etc., in Fig. 3. Transfer all the distances 7^07^1, 6^06^1, 5^05^1, etc., in Fig. 3, over to their corresponding ordinates in Fig. 4. An even drawn curve through these points locates the rivet line or seaming line. Laps to be added accordingly.

Elbow With Gore

Fig. 5 illustrates a two-course 90-degree elbow, with the section BKC cut away to clear an obstruction, the gore BCH being fitted to the resultant opening. Fig. 9 shows the templet for the gore, and Fig. 6 for each of the courses.

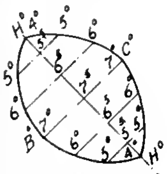


FIG. 9

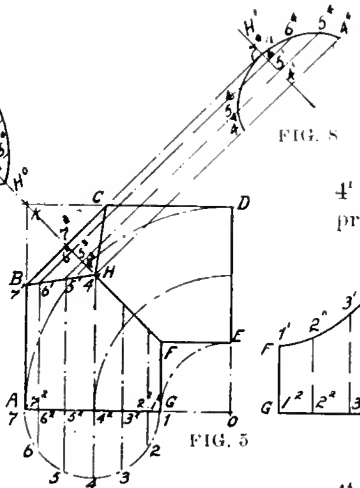


FIG. 8

FIG. 5

Measure off on the line AGO, Fig. 5, AG equal to 1½ inches and GO to ¾-inch. With O as centre and OA as radius, strike the quadrant AD. With OG as radius and O as centre, strike the quadrant GE. Connect D to E, which is in line with O and at right angles to AG. Bisect the quadrant AD, and through this point draw a straight line from O to K, thus locating the mitre line. Draw KA at right angles to AG, and KD parallel to AG. Locate the points B, C by measuring ⅞-inch from the point K. Connect B to C, thus defining the portion cut away.

With 4^2 as centre, draw in the half-sectional view 7, 4, 1. Erect the perpendicular 4^24^1 on the line AG. The point H where the line intersects the mitre line KF will also locate the termination of the gore. Connect B to H and H to C, which makes BH and CH the mitre lines between the gore and the courses. Divide the half-sectional view into a number of suitable equal spaces, as shown. Project the points 6 and 5 to their intersection with BH, also the points 3 and 2 to the mitre line HF.

The stretchout GAG, Fig. 6, equals 3.14 times the neutral diameter 7 1, which equals $3.14 \times 1\frac{1}{2}$ = slightly less than 4¾ inches.

Measure off GAG, Fig. 6, equal to 4¾ inches. Divide this into 12 equal spaces, erect perpendiculars and number in relation to their corresponding lines in Fig. 5. Set the dividers to the various distances, 7^27^1, 6^26^1, 5^25^1, 4^24^1, 3^23^1, 2^22^1, 1^21^1, in Fig. 5, and transfer these over to their allocated lines on Fig. 6. An evenly-drawn curve through these points locates the mitre or rivet line. Fig. 6 illustrates the templet, to which must be added laps according to requirements, whether for seaming or riveting.

The gore BCH will now be dealt with. It is here necessary to have a cross sectional view through the plane $H7^3$, Fig. 5, to obtain the true length or stretchout of the gore, which is foreshortened in the elevation view shown in Fig. 5.

The cross sectional view is shown in Fig. 8.

The construction of such is as follows: From the points 7^1, 6^1, 5^1, 4^1 draw parallel lines to BC, and project to the points 7^4, 6^4, 5^4,

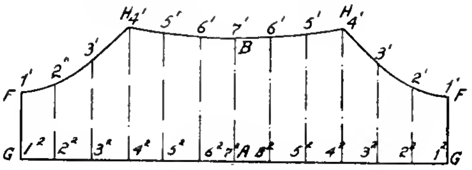


FIG. 6

4^4, Fig. 8. Draw in the line H^1F^1 parallel to KH, and right angles to the projection lines, 7^17^4, 6^16^4, etc. Now with distance equal 4^24 in plan view, Fig. 5, measure off the distances 4.4^4 in Fig. 8. Similarly with distances 5^25 and 6^26, Fig. 5, transfer to $5{,}5^4$ and $6{,}6^4$, Fig. 8. Draw an even curve through these points. This shows the true length of the gore through 7^3H, Fig. 5. The mitre line FK is extended to H^0H^0. On this is laid off the true length of the gore which has just been computed.

The exact length of the distances 7^4 to 6^4, 6^1 to 5^4, and 5^4 to 4^4, measured along the curve, is transferred to Fig. 9, as 7^5 to 6^5, 6^5 to 5^5, and 5^5 to 4^0. Lines are drawn through these points at right angles to the line H^0H^0. The distances on the gore BCH, 7^37^1, 6^36^1, and 5^35^1, Fig. 5, are transferred and measured in Fig. 9, as 7^57^0, 6^56^0, 5^55^0. A curve drawn through these points completes the pattern, with the exception of the laps. This curve locates the rivet lines, and all the points of intersection on the templets, Figs. 6 and 9, may be used for the pitch of the rivet centres through which the holes may be punched—by the punch already referred to, so as to facilitate the fitting up of the paper models—and in the case of plates for riveting together by.

TEMPERING REAMERS AND TAPS

A GOOD way to harden a long reamer without warping is to suspend the reamer and tongs by a twisted string. When the reamer is heated properly, hold it over the tub perpendicularly by the string in one hand, and keep it from turning with the other. When ready let go and allow it to revolve rapidly and dip at the same instant. Reamers or taps hardened in this way will remain straight. This idea is worth testing, not with a bit of twisted string, but with a proper mechanical rotor, the speed of which could be varied in the experiments. There are many small cutting tools which cannot be hardened and kept to their required form. A good many twist drills are not very straight after tempering.—Ex.

PREVENTING CORROSION IN BOILERS

IT IS extremely doubtful whether the suspension of zinc slabs in a boiler will prevent scale, says the Electrical World. Scale is due to the presence in the feed water of substances like the sulphates and carbonates of lime and magnesia. When the water is heated, these substances are precipitated and are baked on the plates and tubes. The action of zinc in a boiler is galvanic and is intended primarily to prevent corrosion of the metal parts of the boiler. To prevent scale formation, it would have to change the nature of the sulphates and carbonates or else keep them from coming in contact with the boiler, neither of which it is able to do.

It is true that in the course of the galvanic action set up by the use of zinc, hydrogen is set free at the water surface of the plates and tubes, and the liberation of hydrogen in this way, if rapid enough, might prevent scale from adhering; but it is scarcely to be believed that the feeble galvanic action set up by the use of zinc slabs could produce hydrogen at a sufficient rate to keep all sediment and precipitates from collecting on the surfaces on the metal.

Steel Piston Rod Tests.—An American steel concern has announced the results of a series of tests on piston rods made of the steel it manufactures. The steel showed a tensile strength of 123,775 lbs. per square inch, an elastic limit of 82,600 lbs., with an elongation of 24 per cent. in 2 in., and a reduction of area of 53 per cent. In a revolution testing machine, 984,933 revolutions were required to break the test pieces at a stress of 30,000 lb. per square inch. This steel, which contains manganese, is produced in an electric furnace.

Papers Read at the Recent Foundrymen's Convention

Selected from the more important subjects presented for discussion before the Annual Convention of the American Foundrymen's Association and the American Institute of Metals at Atlantic City, N.J., during September, 1915. The papers cover a wide field of foundry and allied activity, the nature of the results and the completeness of the reports making them of particular interest to all who desire to keep in touch with metallurgical progress.

THE CONVERTER IN STEEL CASTINGS MANUFACTURE

By C. S. Koch*

A WRITER of a paper on the manufacture of steel castings, some four or five years ago, started with the following words: "This subject has already been discussed so thoroughly before this association, that not many points remain uncovered." Since then there have been numerous additional papers. Consequently, it has been difficult for the writer to dig up something not yet touched upon, which would still be of general interest. There have been refinements in many ways, but they are generally too detailed to go into. If one looks over the Transactions of the Association, he will find a large amount of good matter on the converter. He will find papers on its construction, its lining, its manipulation, and its chemistry, and all the details pertaining thereto, all of which is of interest to those who are in close touch with the subject. However, little is found in regard to the various factors which have tended to make the converter a successful means for making steel in many cases and equally as disastrous in as many more; little material is available giving reasons why the converter is still being run in some foundries after 10 or 15 years, and why it was run six months or less in others. The writer proposes to discuss this subject.

Is the Converter Practical?

If, say 10 or 12 years ago, the following question were asked, "Is the converter a practical means for making steel for castings?", the total number of replies in the affirmative would have been less than 10. That is, replies from men whose experience would justify their endeavoring to answer the question. The number of negative replies would have been almost too great to record. The proportion would have been about nine negatives out of 10 answers. If the same question were asked to-day from the same class of individuals, the trend of replies would be just about the reverse. The converter process has about as large a proportion of adherents to-day as it had adverse critics 10 years ago.

Up until about 1905, the failures greatly exceeded the successes. For the next five years, the number each way was nearly equally divided and of late years, the successes have been, probably, in excess of the failures. But we must not lose sight of the fact that news of a success is published, while that of a failure is squelched. In the early days, the failures were not due, as we might suppose, to the crudity of the process, but rather, as a rule, to the fact that in a great number of cases the converter was being employed for purposes for which it was not adapted and was being wrongly applied. Better results have been obtained in recent years because the users have exhibited better judgment in the selection of the particular lines into which they have entered.

This can be demonstrated by an analysis of the history of the converter foundries of the United States. In making this analysis, trade conditions must be taken into consideration as they vary from one locality to another.

The conclusions from this examination seem to show that the following statements are approximately true:

1.—The application of the converter to the manufacture of a general line of railroad car castings has not, to date, been a success.

2.—The use of the converter in conjunction with an open-hearth furnace has not generally met with success. That is, the open-hearth foundries, which have endeavored to add the converter to their equipment, have nearly always given up this process after a short trial.

3.—Iron foundries which have endeavored to add the converter to their equipment, except in favored conditions, have been unsuccessful.

4.—Various manufacturing companies, having a fair consumption of steel castings, have not by any means been satisfied with the results of making a small tonnage for their own use.

Why Success Was Achieved

On the other hand, the resume of the history will show the companies that have been successful, and in almost every case it will be found that these companies have employed the following methods:

1.—They have made steel by no other process.

2.—They have adhered, as a rule, to a maximum metal line, or perhaps, we might say, weight of casting. This weight has varied somewhat in different localities, as competition and a few other conditions have varied.

Now all these causes for failure and success can be argued pro and con and exceptions can be cited. Nevertheless, if anyone is considering the application of the converter to the steel foundry business, he would do well to give due weight to the foregoing, because the statements given are not the result of theoretical considerations, but of a detailed analysis of the history of the converter business for the past 15 years.

It will be noted that in the writer's opinion, the reason for successful operation has been careful consideration of the maximum weight and the question naturally arises, what is this? It will vary in different localities, but is more or less dependent on the proximity, activity and attitude of open-hearth steel foundries.

Generally speaking, converter steel costs more than open-hearth steel. Consequently other things being equal, such plants can underbid the converter plant on all such castings as they can properly run. Therefore, if a converter foundry is in a locality where open-hearth competition is keen, the maximum weight of the castings which it ordinarily can take at a profit will be less than in the case where such competition is remote or less active. In considering this competition, there is another element that should not be overlooked. The manufacturer of large, heavy castings naturally has a lower average overhead per ton, and unfortunately in many cases, this small overhead expense is spread equally over the large and small work. In bidding, this naturally puts the converter plant at a disadvantage, with the logical tendency of restricting the converter plant to castings which the open-hearth cannot run; that is, restricting it to smaller and smaller castings.

Effect of Increased Skill in Molding

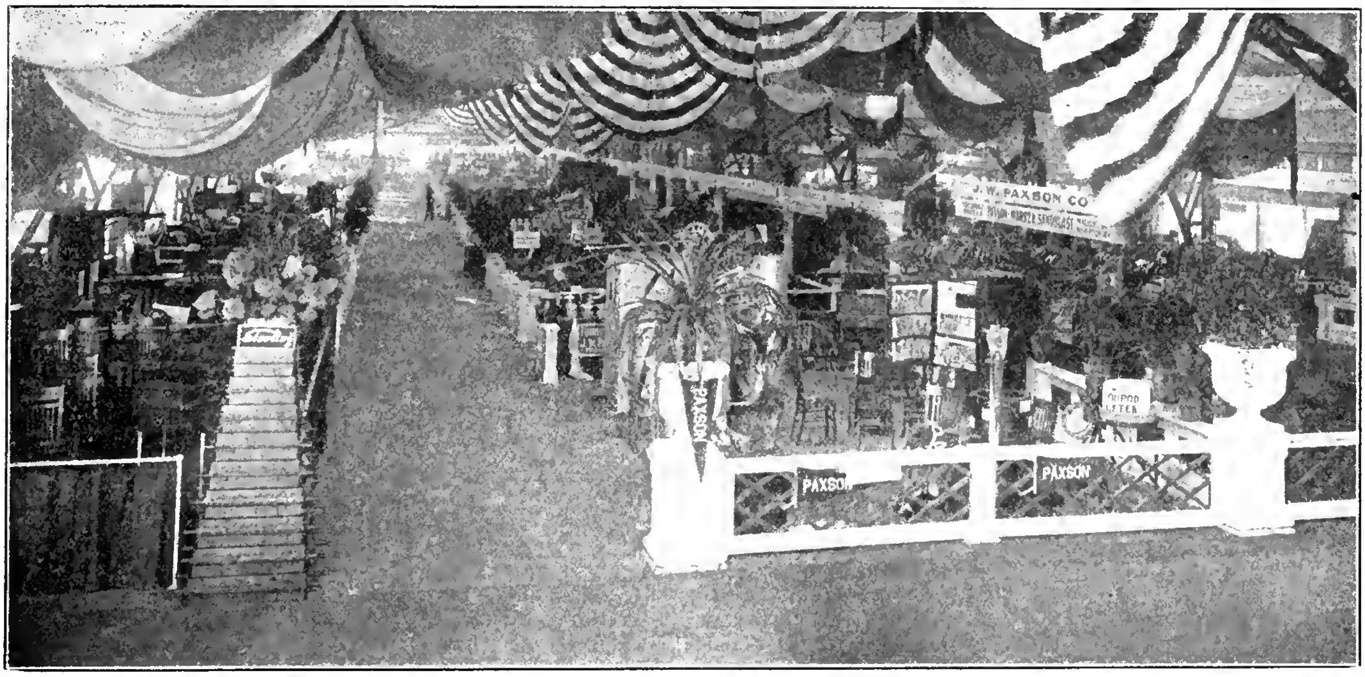
Again, the tendency in some localities is for the manufacturers of large castings to encroach more and more on the field of the converter shop owing to increased skill in molding. It is believed by the writer that owing to various conditions, greater skill in molding difficult, medium-size castings was formerly possessed by the converter plant. During every dull period, in their desire for work, the manufacturers of large castings have gone after more difficult jobs. This has developed their skill and given them confidence.

We have already stated that in the past, success was more or less dependent on restrictions to small work, and these latter considerations show that in the

*Fort Pitt Steel Casting Co., McKeesport, Pa.

future the converter plant will be compelled to carry this restriction further. There are, however, modifying features that should be given weight. There are converter plants strewn all over the country, located in districts where ordinary competition from the cheaper metal does not exist. These reap profits not possible to others. For example, the plant may be at such a distance from outside competition that the buyer is willing to pay a price sufficiently high to enable the converter plant to take the work with a reasonable profit. Proximity to user is always a valuable feature.

Most all conveiter plants, even the successful ones, handle some large work. This is obtained on the basis outlined previously, but it would not be safe to bank too much on this as being a particularly lucrative part of your business. From all of the foregoing it must not be concluded that the amount of work to be done by a converter plant is to grow less. On the contrary, new uses for steel are being found, which will give the industry more work than formerly. It is an adjustment of classes that will follow.

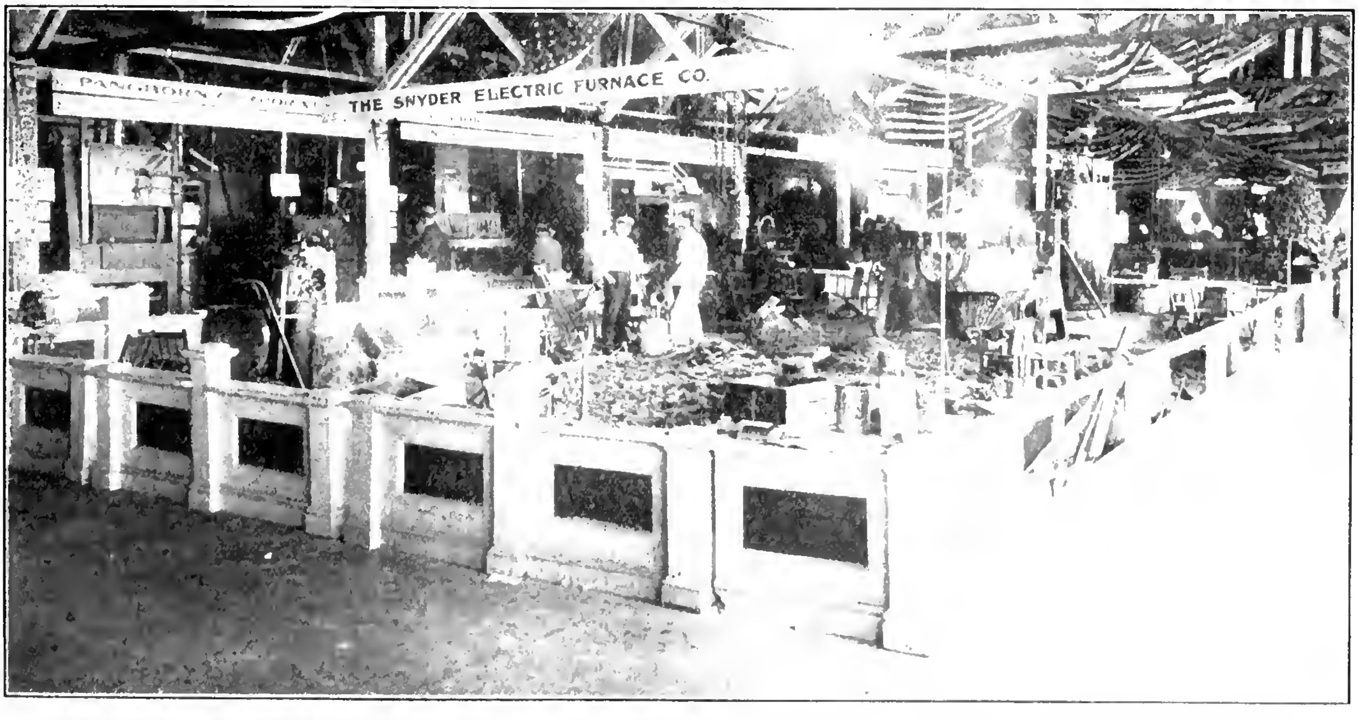


GENERAL VIEW IN ANNEX, FOUNDRY AND MACHINE CO. EXHIBITION, ATLANTIC CITY, N.J.

Shop Practice

To return more particularly to the application of the converter, there are a few fundamental principles of operation that it may be well to mention. These, again, are not theoretical considerations, but are brought to mind by a study of what has been accomplished and **not accomplished** by the converter plants of this country:

The points I wish to make are as follows:



MACHINERY HALL EXTENSION, FROM LOWER END, FOUNDRY AND MACHINE CO. EXHIBITION, ATLANTIC CITY, N.J.

1.—Unusually good cupola practice is essential.

2.—The speed of the cupola should be regulated to the speed of the converter, that is, neither too slow nor too fast.

3.—Proper crane facilities are necessary.

The writer has endeavored to learn the causes, (a) of complete failures, (b) of the cases in which there was perhaps no real failure, but in which there was a discontinuance in the use of the converter, and (c) of mediocre success. As far as the steel-making end was concerned, these could be attributed to a bad combination of the three operations listed.

Holding the cupola back in any way whatever, to wait for the crane or the converter is not good practice, especially when the economical operation of the converter requires the use of a burden of perhaps 40 per cent. steel scrap. It should not be necessary to say much on this subject to foundrymen, but strange to say many converter foundries can be adversely criticized on this point. Quality and temperature of iron should be considered and if a large number of heats are to be taken off, the time element is essential. As is well known, a 2-ton converter will produce steel at the rate of two tons every 20 to 25 minutes. If 12 heats are produced daily, an unnecessary delay of only five minutes per heat will aggregate one hour. It is well not to be obliged to start pouring any earlier in the day than is necessary on account of fumes and heat, but at the end of the day overtime is not only costly, but has many other disadvantages. Consequently, quick operation, at a uniform rate, is helpful, and this can be obtained only by a well-run cupola that is not too slow for the converter, and by proper crane facilities, arranged to remove the steel from the converter as soon as it is blown and to immediately refill the converter with iron. The crane should not be busy pouring off, when it is wanted at the converter. A wait means holding back the cupola, which means not only loss in time, but bad iron later in the day. That the ideal relationship of cupola, converter and crane is not present in many foundries is not the fault of the foreman or superintendent, but is due to original faulty design.

Temperature of the Steel

Furthermore, the temperature of steel should be uniform from heat to heat and should be adapted to the class of work turned out and arrangement of the shop. The need of some shops is for steel much hotter than others. This is logical and correct and one might say that each shop has its own particular ideal temperature. This should not be higher than necessary, as heat is costly. Most shops do not seem to aim at any particular temperature. The result is changed temperature conditions daily. This puts the foreman at a disadvantage in guiding his molding practice.

If the ideal shop temperature is eventually attained, there still remains a difficulty. The steel will be too hot for some castings and too cold for others, and will burn in badly on some and not run others. To avoid this and many other foundry difficulties, the policy of the company should be toward a narrow range of sizes. It will be argued that this cannot be done in a jobbing shop, which must take whatever comes. The only answer to this is that such a statement is like many others emanating from foundrymen. We are in a rut and not until we get out, and break away from antiquated, preconceived principles, will we attain the highest degree of success. Establish your class and range of sizes and adhere to it. You will loose some work to the other fellow and at the same time take some from him. In time your plant will be operating on work for which it is best adapted, and your competitor will be doing likewise. You will have made the first step in specialization. In conclusion, let me say that the first step to take in the practical application of the converter to the steel foundry is to specialize, being sure that it is on that class of work to which the converter is best adapted.

GRAY IRON CASTINGS DEFECTS—THEIR CAUSES AND REMEDIES

By Herbert M. Ramp*

A COMPREHENSIVE discussion of the causes of defects common to gray iron castings and remedies for overcoming them would encompass the consideration of practically every foundry operation, but unfortunately the time at our disposal will permit only of a brief review of this interesting and complex problem. A discussion of the losses incurred by defective castings is one of the first things a man hears when he enters a foundry and it usually is the last thing that comes to his notice when he leaves it. Unfortunately, more attention is given to the losses incurred by defective castings than to making improvements that will eliminate practices that cause them. More consideration is given the pounds of bad castings a molder produces than to his output of good work. Also, more importance is attached to the bad castings reported than to the cost of productive labor per ton. The reason for this is not hard to find. The one is a tangible, direct loss that stares the foundryman in the face every day, while the others are intangible factors that can be corrected by the exercise of gray matter and the installation of proper equipment.

It is estimated that defects common to gray iron castings are the direct cause of the rejection, or loss, of at least 5 per cent. of the iron castings produced. Some patterns may have a better record, although many, also, will show a higher percentage of loss. This estimate on the average, however, is low. If this loss were eliminated many foundries struggling for existence today could not make a profit on their operations. The reduction of the defective output is a problem of great importance and should command the earnest attention of every foundryman.

Ninety per cent. of all defects can be attributed to two causes, namely, incompetency and carelessness. However, since it is exceedingly difficult to obtain competent and careful labor, the operations involved in making castings to-day must be so safeguarded and simplified that a lesser degree of experience, intelligence and care is necessary to the successful operation of the casting plant than heretofore. Classifying casting losses in the order of their causes, it will be found that 50 per cent. can be attributed to the sand and its treatment, 20 per cent. to the cores, 10 per cent. to the patterns, five per cent. to equipment and five per cent. to the iron.

What constitutes defects in gray iron castings is another question of great importance. The standard of excellence for the different classes of castings varies and consumers using castings of a similar nature for the same purpose, frequently will have widely varying requirements. In other words, castings that will be accepted by one company will be rejected by another, and the line differentiating sound from defective castings is drawn at different points. In this respect every consumer is a law unto himself, and there really is no standard for casting quality. Each consumer fixes what he considers a standard for his own requirements which he believes is adequate to his needs.

Sand as a Cause for Defectives

No effort will be made to enumerate the many causes leading to the production of defective castings as the list will be entirely too long and, furthermore, in many instances the causes are so obvious that further comment is unnecessary. However, some practices are common to many shops which cause needless expense, and these are repeated day after day in one form or another without an intelligent effort being made to correct them. The sand, and its treatment, is probably one of the most prolific causes of defects, and to it can be attributed more losses than to all other causes combined. In three cases out of four, the sand is the cause of dirty castings: it causes the mold to cut and the castings to scab and blow. If a casting blows, it is generally attributed to the cores, the

*Elmwood Casting Co., Cincinnati, Ohio.

sand or its treatment, and its repetition is guarded against. However, the cause of the cut, scab or buckle is not investigated carefully, notwithstanding the fact that the losses thereby incurred are deadly to profits. It is the small defect that causes the foundryman to stop and wonder if the casting will pass the machine shop, but finally after it has been cleaned and shipped, it is returned with a caustic letter of complaint. It might be pointed out in this connection that the little foxes spoil the grapes. A casting that is defective beyond question usually points out its own remedy, but the casting which is questionably defective is the most elusive. The remedy is not sought as earnestly or intelligently as that causing the larger defect, neither discovers a scabbed casting, he usually tells the molder to be more careful, or advises him that the mold was too hard or too wet, or whatever his judgment dictates, but how often does he examine the facing and the sand? How often does he employ every possible resource to secure better sand or to make mixtures of sand for his work that are more satisfactory? How often does the foundryman show the molder how to ram the mold, to vent or finish it? How many foremen to-day believe that they discharge their duty by merely telling the men in their employ what is patent to any one who has walked through a foundry a few times in place of personally instructing them how to avoid their troubles and to do their work right? tion of the supervising force. The molder next must be instructed in its use and if defects develop in his work, he must be taught, regardless of the fact that he may have pounded sand for 40 years. It is futile to attempt to formulate fixed rules covering supervision and instruction, since every foundryman has individual ideas on this subject. However, not many realize that the cause of defective castings might be eliminated if they would start at the sand bin and see to it that the best possible sand is obtained and that the proper instructions are given regarding its use. Too frequently, also, this instruction partakes of the form of criticism, when the molder is called to the scrap pile where his defective castings

MACHINERY HALL, LOWER END, FOUNDRY AND MACHINE CO. EXHIBITION, ATLANTIC CITY, N.J.

are the molders instructed as carefully to prevent the causes of small defects as of those which are more apparent.

The foundryman usually becomes provoked and exceedingly angry when a molder has a run-out or breaks a casting hot. He views this in the light of exceedingly poor workmanship, but he considers in an entirely different spirit a casting that is slightly scabbed or dirty. The casting that is almost good enough offers the most difficult problem and the cause of its defect, as a rule, cannot be determined readily.

Scabs, Cuts and Buckles

Scabs, cuts and buckles come and go. They vary with the temperament of the man who wields the rammer and the vent wire and blossom forth with the use of too much water, too much finishing, too little venting and the use of improper sand. When the foundryman

Poor or misused sand is the cause of more defective castings than any other factor. It has a decided influence on the cost of the product and may be the means of establishing a reputation for high grade or poor castings. It is the foundation upon which the entire foundry structure is built. Suitable sand means better and cheaper castings, lower losses and an easier shop to operate successfully. It is one of the great fundamentals of a happy business.

Preparation and Use of the Sand

Next in importance are the instructions regarding the preparations and use of the sand after its careful selection, consistent with its cost. However, cheap sand frequently is the most expensive raw material that a foundry can buy. The sand must be mixed and tempered for the particular work for which it is required and this must have the atten-

are pointed out to him in no uncertain terms. In other words, in most instances, what should be well-intended instruction, is mere denunciation. Anyone can find fault, but a man must study his business if he wants to place himself in a position where he may be able to correct bad practice. The average molder does not lose a casting on purpose. He feels regretful over its failure, but the average molder does not always know the underlying cause of defects, nor how they may be overcome. He needs help, not hell, which he usually receives. He must be taught the rudiments of the business over and over again, since the conditions of the trade are changing constantly. This is the remedy that must be applied by the supervising force before the defective losses can be reduced. If the same energy is expended in instruction as in

condemnation, far more satisfactory results will be achieved.

Dirt Another Cause of Defects

Dirt ranks as the second of the prolific causes of defective castings. From a molding standpoint, the casting may be perfect, yet it is dirty in the rough, or it may display dirt spots in the finishing operations. The number of excuses attributed as the causes for dirty castings is legion, yet only two can be assigned for this defect. Either the iron does not lie quiet in the mold, or against the cores, or dirt has been permitted to enter the mold with the iron, or it was in the mold at the time when the metal was poured. Occasionally the blacking may wash; again the gates will cut, but more often the dirt can be attributed to the same cause as that of the scab or buckle, namely, improper sand, or its improper treatment. A casting will not be clean when the iron does not lie quietly in the mold. The metal may not boil or agitate sufficiently to cause a scab, yet its effect is apparent on the finished casting. If the slag which accumulates on top of the iron is permitted to enter the mold, the casting, of course, will be dirty and this is true also if the gates cut or scab, or if the gates or runners are improperly constructed, or are defective in any way. It is possible to make a perfect mold, yet if the gates are improperly made, the casting will be dirty and will prove defective. Here again the remedy is care and supervision.

Sources of Dirt

An excuse generally offered for defectives is dirty iron. This is the bulwark behind which the molder hides and is the shield which he employs to cover his shortcomings. First of all, it might be well to direct attention to the fact that iron and dirt are enemies and have nothing in common. The dirt referred to is the foreign substance that occurs or forms on the upper side of finished castings. Iron and dirt have no affinity and are of widely different specific gravities. Ninety per cent. of the so-called dirt in castings is composed of silica, alumina and magnesia and none of these is mixed with iron mechanically. They will not remain in solution by any known process, but they may unite to some extent chemically, in this event changing the chemical composition of the iron. This, of course, could be readily determined. However, the natures of these elements are not similar, repelling each other, which is indicated when such substance rises to the surface of the metal in the ladle. Some of the different oxides contain iron, being formed while the iron is in a liquid state and subjected to the action of the oxygen in the air. These oxides also are classed as dirt. However, this dirt, the same as any other refuse that rises to the surface of the metal in the ladle, must be skimmed-off before pouring and does not form a part of the iron. Oxides cannot, form, however, after the casting is poured.

Dirty Iron.

Iron is unlike most of the non-ferrous metals, in that it will form only a comparatively few combinations with the exception of those produced in the blast furnace. It repels all but a few elements that are taken up in almost constant proportions and these only at extreme temperatures. Regardless of the composition or the character of the iron, if it is melted and poured fairly hot, it will be clean. The sulphur may be 0.05 or 0.20 per cent. the manganese may be 0.20 or 2 per cent., the phosphorus may be 0.10 or 1.25 per cent., but none of these varying contents of these elements will make iron dirty in the castings. The iron may be too hard, too soft, too open; it may shrink, crack, draw or warp, but dirt is not its inheritance, nor its progeny.

During the past 25 years, the author has had direct charge of the mixing and melting of more than 500,000 tons of iron, but he has yet to find dirty iron in the sense assigned for it by the molder. Why does a molder make nine castings good and one bad? Why does a molder make a clean record for 30 days and then lose everything he makes? If a molder can produce 20 good castings why is he unable to make 21 or 200? These are the questions put up to the foundryman every day and he has yet to give a convincing answer. First of all, there are no standards or set regulations governing foundry work. The sand may be wet down more one day than another and this makes different the ramming, venting and finishing problem if the castings are to be good. The iron may be colder and duller one day than another, and this would necessitate the use of gates of different size, or different pouring arrangements and the cores may be swelled out of shape, which would require different methods of securing. The flasks may be worn out and finally give way and a hundred other conditions may arise which never are the same on subsequent days.

Inexplicable Foundry Problems

Little has been done in most shops to remove the many causes of defective castings, except in foundries specializing in a particular class of work. No effort has been made to catalog the ills of the foundry and no one has attempted to place the foundry business on a level with the machine shop. If this were done, many and marvelous changes would be made. The patterns, core boxes and flasks would be inspected daily, the sand would be prepared by machinery and the different grades and ingredients would be carefully measured; different rules would be laid down covering the pouring temperature of the metal, as well as the methods of gating. The foundryman would have a voice in the design of the patterns and he also would have the patterns made, not the cheapest way, but the most satisfactory way for foundry use. Every possible pattern would be mounted on a molding machine instead of placing so much dependence upon the skill of the individual operator. Either by lectures, by a school course, or through technical papers, would be imparted to the molders the knowledge gleaned by the employers as the result of the development of the business. Premiums would be paid for high grade service and efficiency.

The foregoing and many more factors would contribute as remedies for defective casting losses. Unfortunately, these needs cost money and the trail has to be blazed; some must be pioneers in elevating foundry practice to a class where definite standards exist and where definite practice will produce definite results.

The Personal Equation

In a large measure the personal equation will have to be limited and particular jobs will have to be so safeguarded that if Tom Jones lays off a day, his substitute won't make 50 per cent. scrap; that if Mike Murphy has been out the night before, he won't spoil his day's work; or, if a molder has sickness at home, he won't forget some minor detail and ruin his casting. More of the responsibility, judgment and skill must be taken away from the individual and the work must be placed upon a higher mechanical basis than it is to-day. Then, only, will the beginning be made for the elimination of defects in castings. An honest comparison of the defective work of the ordinary jobbing foundry with that of the shop equipped for a special line of work, proves conclusively that defectives can be reduced by placing operations on a higher mechanical plane.

Tellurium belongs to the same chemical group as sulphur and selenium, but unlike these two elements, tellurium is a metal, and resembles antimony in a general way. Tellurium fuses at 500 deg. Cent. and when heated above this point it burns with a fine blue flame to tellurium dioxide, at the same time evolving a very peculiar odor. Its combination with hydrogen forms the very poisonous and colorless gas hydrogen telluride.

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Machine, Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

SELF-CONTAINED GRINDING MACHINE

THE grinding machine illustrated herewith is driven by a direct connected motor located towards the rear on the left side. The motor is within the working space of the machine, and as all speed changes are controlled within the unit, it thus possesses the unique feature of being self-contained, no external belting or other driving devices being necessary.

In accordance with the maker's established practice, the grinding wheel travels, while the work revolves in a stationary position. It is claimed that this arrangement reduces the power necessary to operate the machine, much of which would otherwise be absorbed in moving considerable weight instead of doing useful work.

The swivel table has two scales, graduated in degrees, and also in inches per foot. The speed changes for the work are made by shifting a belt on cone pulleys, the mechanism for which is operated by a single lever.

The grinding wheel head is massive and rigid and is mounted to slide on a large V and a flat guide. The spindle, which is of special steel, runs in adjustable bronze bearings, while the driving belt is maintained at a uniform tension by an automatic tightener.

Grinding wheel feed is automatic or hand, the automatic feed varying from .00025 in. to .007 in. at each reversal of the wheel carriage.

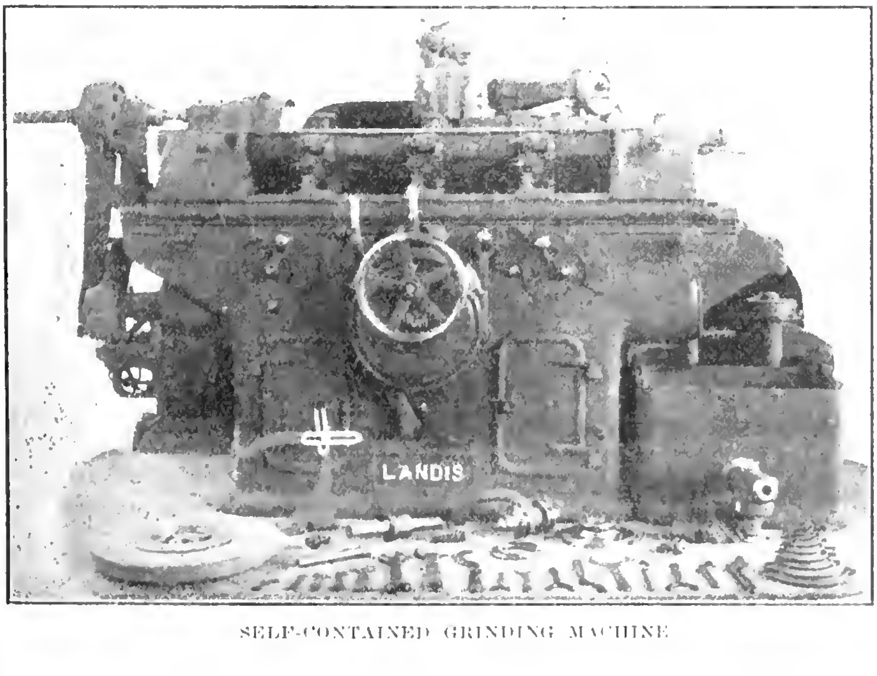
The traverse of grinding wheel is automatic, the movement of a single lever controlling all the speeds by means of a belt on cone pulleys. A period of dwell or tarry which can be varied to suit the work is arranged to take place at the reversing points. Two-point rests with independent adjustment and stops for each support, are provided.

FIG. 1—FLEXIBLE STEEL AIR COMPRESSOR VALVES

The machine is liberally proportioned having a 5-inch driving belt, and 20-inch diameter grinding wheels of 1½ in. and 2½ in. face. Power required is 12 horse power; floor space 8 ft. x 5 ft. net weight 7,800 lbs., boxed for export 9,500 lbs.

When driven from line shaft, an auxiliary shaft with tight and loose pulley, 12 in. diameter, running at 450 r.p.m., is furnished.

The Landis Tool Co., Waynesboro, Pa., who are the makers of this machine, supply a complete outfit of accessories as part of the regular machine equipment.



SELF-CONTAINED GRINDING MACHINE

HIGH SPEED VERTICAL AIR COMPRESSOR

A LINE of air compressors of the high-speed, vertical type exclusively, is being marketed by the Gardner Governor Co., Quincy, Ill. The Gardner-Rix compressors are specially designed to give satisfaction where skilled attention is not always available, and toward this end the mechanism has been simplified to the greatest possible extent.

Light sheet steel valves (see fig.1) are employed. These are flat rings of flexible sheet steel, noiseless in operation, and subject to practically no wear after long periods of service. The valve areas are large insuring economical working.

Enclosed crank cases with splash lubrication are a feature of all the types of these compressors, while the absence of stuffing boxes and crossheads, and the reduced weight of working parts enables higher speeds to be adopted whereby the capacity of machines having cylinders of certain size can be increased. This allows the use of high speed motors on combination units, without having to use gear reductions of excessive ratio.

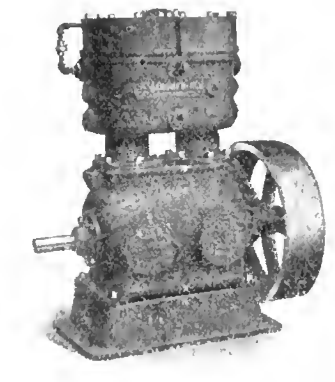


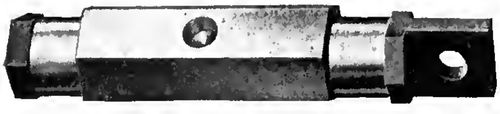
FIG. 2.—CLASS "H" COMPRESSOR

Duplex cylinder compressor with sub base is shown in Fig. 2. Gasoline driven sets, portable outfits with tanks etc., for all classes of work are furnished by the makers, having capacities from 8 cu. ft. to 140 cub. ft. per min. at pressures from 75 to 250 lbs. per sq. in. Cylinder dimensions are from 3 in. bore x 3½ in. stroke to 8 in. bore x 6 in. stroke, weights vary from 165 to 1800 lbs.

PNEUMATIC VIBRATOR

AMONG recent products of the Malleable Iron Fittings Company of Branford, Conn., the "Branford" vibrator is prominent. This device is made in all sizes from ¾ inch to 2 inch. It is an

instant starter and possesses the unusual feature of having all parts hardened and ground, which justify claims



"BRANFORD" VIBRATOR

to long life, economy in air consumption, and ample power capacity.

The makers guarantee this apparatus against defective workmanship or material.

FUEL OIL HEATER AND STARTER.

THE use of liquid fuel for steam generating purposes, etc., is becoming more common every day, especially near the large oil fields. In burning crude petroleum, the fuel must be heated to above 200 deg. F. before it can be easily vaporized in the furnace, preparatory to combustion. This heating is practically always accomplished by steam heaters, the oil being passed through coils around which steam is circulated.

When starting up a dead boiler, steam must be borrowed from a live one to heat the oil and to pump it to the furnaces. If, however, no steam is available, a wood or coal fire, with its attendant dirt, must be resorted to. If a furnace is to burn liquid fuel it should be constructed with that object in view. The best results cannot be obtained if the furnace has to be adaptable to burn coal or wood to raise steam and to switch over to oil when sufficient steam is raised to supply the furnaces with fuel heated to the proper temperature.

The "Reichenbach" fuel oil heater and starter has been designed to eliminate the coal or wood fire trouble when raising steam. It consists in the main of a pump, a heater coil and a kerosene torch. Fig. 1 is a partial longitudinal section of the heater and starter, and shows the internal construction. The oil inlet is connected to the main supply line, the pump drawing oil which has passed the suction strainers and delivering it, through the heater, to the furnaces. The kerosene gas burner, standing upright in the centre of the fire pot, heats the oil as it passes through the coil of pipe. The tank on the right carries the supply of kerosene, which is kept under a slight air pressure, by means of the small hand pump.

The base of the apparatus is in the form of a tray, and is made oil-tight, thus preventing the spreading of oil should any accidentally be spilt. The suction flange of the pump is tapped for the nipple and a shellac joint is placed between the flange and the tray. Where the kerosene supply pipes pass through the bottom, the holes are tapped and the pipe threaded through and secured with a lock nut.

The fire pot is provided with an air re-

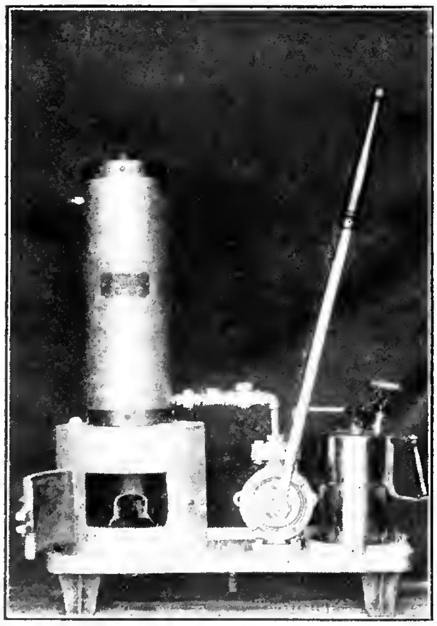


FIG. 2. THE "REICHENBACH" HEATER AND FUEL OIL STARTER.

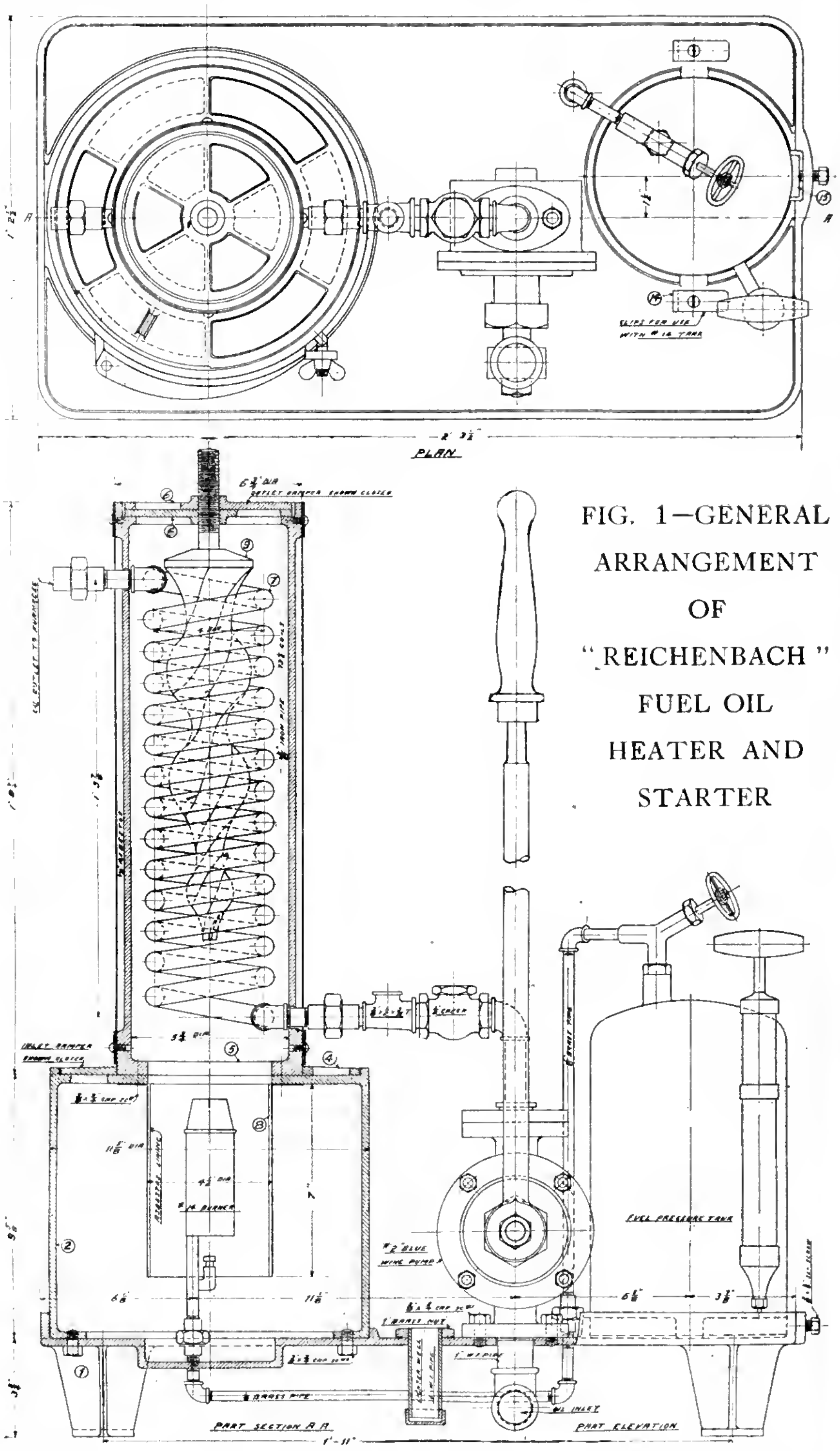


FIG. 1—GENERAL ARRANGEMENT OF "REICHENBACH" FUEL OIL HEATER AND STARTER

gulator at the top for supplying air to the burner, which obviates the necessity of keeping the door of the pot open when the machine is in use. Closing this regulator completely shuts off the air supply to the burner, and will extinguish it instantly. Another regulator is provided on the top of the heater barrel. To direct the air to the bottom of the pot, an asbestos-lined petticoat is provided; this can be seen through the open door in Fig. 2. The petticoat is constructed of three segments, the two segments facing the front being arranged to swing outwards to facilitate the removal of the burner.

The heater proper consists of a coil of 3/8-in. wrought iron pipe, through which the fuel oil is forced. The coil is carried in a cast iron cylinder, lagged with planished iron, and bound top and bottom with polished brass bands, the space between the cylinder and the lagging being filled with asbestos. A peculiar-shaped cast iron damper is provided to spread the flame from the burner and to direct it on the heater coils. The damper is hung on a threaded spindle, and its position can be regulated, up and down, to get the best heating effect.

The burner is lighted by placing an asbestos ball, which has been soaked in kerosene and lighted underneath, until the burner is hot enough to vaporize the kerosene, which vapor is then ignited. Heat from the burner thereafter automatically keeps it supplied with kerosene vapor. An extinguishing receptacle is provided between the fire pot and the pump, in which is kept the asbestos ball.

The pump is of the four-valve wing type, and can be arranged for motor or hand drive. Fig. 2 shows a hand-operated outfit. When installed, a return connection is made from the heater coil outlet to the pump suction, for the purpose of circulating the fuel oil when starting the heater.

We are indebted to A. F. Menzies, consulting engineer, New Westminster, B.C., for the foregoing data and illustrations.

NEW MODEL COUNTING MACHINE

THE saving of time and labor, the unerring accuracy, and the simplicity of operation of modern calculating machines, are but a few of the features which have combined to render them indispensable to progressive factory managers.

While formerly the applications of counting machines were principally in connection with clerical work, the benefits to be derived from their judicious use have caused them to come more closely in contact with actual manufacturing conditions.

Some marked improvements in design are shown in the new models of counting machines made by the Durant Manufacturing Company of Milwaukee, Wis. Model "D" counter, illustrated herewith, is a recent production by this firm, and amongst other advantages, it is fitted with a knob at the left of the case, by means of which the operator can instantly re-set the machine or clear it to zero.

MODEL "D" COUNTER.

These machines are being used to a very liberal extent on stamping presses, punches, screw machines, conveyors, etc., for automatically counting product as it comes from the machine.

In factory offices they are of great assistance in maintaining exact records of labor, material, sizes, weights, etc.; in fact, all of the elements of modern cost keeping can be handled to advantage with these machines. The manufacturers will gladly send, to interested parties, a copy of their catalogue, which illustrates the many advantages of these machines, and contains valuable suggestions regarding their adaptation to existing conditions.

PORTABLE CHANNEL IRON PUNCH

AN addition to their existing line of portable hand metal punches, has just been made by the W. A. Whitney Mfg. Co., Rockford, Ill., in the shape of a punch for handling channel iron.

The tool as can be observed from the illustration is designed principally for use on channel or other similar flanged work, the gap on the end of frame lever being so shaped that the tool can be slipped over the end of the section and moved along to the desired part.

The portable channel iron punch has a capacity of a 1/4 inch hole through 1/4 inch iron, and can punch to the centre of 4 inch channel iron having 1 1/2 inch flange. It uses the same punches and dies as the makers' No. 2 punch, all the small parts of each being interchangeable. The sizes of punches and dies are from 1/8 inch to 1/2 inch, advancing by 1-32 rds. Sheet metal workers in particular will appreciate the convenience of such a tool.


"WHITNEY" PORTABLE CHANNEL IRON PUNCH.

COMBINED PUNCH AND SHEAR

THIS compact combined punch and shear is capable of a variety of work on structural sections. The unit illustrated, and known as the No. 2 power machine, requires 3 horse-power to operate at its full capacity. It will punch a 1 1/2 inch hole in 1/2 inch iron, and a 1 inch hole in 3/4 inch iron. Angles up to 4 inches can be cut with it, also tees up to 3/8 in. x 2 1/2 in. When used for shearing flats, it will handle up to 5 in. x 1 in., and 7 in. x 3/4 in.

The main frame is built of two heavy castings which are bolted together in a vertical plane, allowing the machine to possess all the advantage due to compact assembly and accessibility while retaining the strength and rigidity of a solid casting.

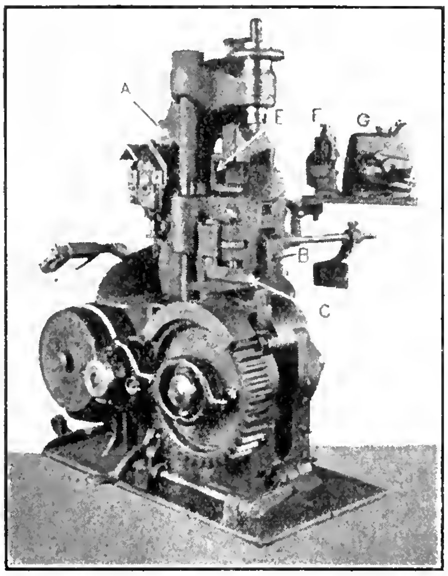
While the three principal operating features — angle cutting, punching and shearing—are individually provided in the design, the use of interchangeable attachments in the punch seat enables tees to be cut and the ends of angles trimmed.

The angle cutter A is located at the back of the machine. The shear is directly in front at B, where a flat is in position showing the adjustable guard C to prevent the work tilting up when being sheared.

The punch seat D which is part of the main frame is designed to accommodate fixtures E.F. and G. which are angle trimmer, punch, and tee cutter

respectively. A swinging shelf allows the change to be made quickly and easily. To the right of the machine is located the length gauge for shear.

All of the cutting parts operate vertically by means of two heavy steel rods actuated from the main shaft and guid-



COMBINATION PUNCH AND SHEAR.

ed in long lossess formed on the main frame.

By means of a suitable arrangement the punch can be brought down to the work and into centre punch mark before starting, thus insuring accurate work. In addition, the machine can be set to stop at each revolution or run continuously.

The total weight is 4,000 pounds; floor space, 4 ft. 6 in. x 3 ft.; pulleys 16 in. diameter for a 3-in. belt. Speed 450 rev. per min.

The builders of these mamachines are the Clark Foundry Co., Rumford, Maine.

SAND MACHINE

FOR castings that must be smooth, perfect, and regular, the preparation of the sand is of great importance. In addition to thoroughly mixing and tempering, the machine shown in Fig. 1 passes the material through a pair of rolls 12 to 18 times, thus pulverizing all small lumps and produces a sand which is smooth, velvety and tough, and possesses an even and regular vent. With the process as used here, one pair of rolls does the work of 12 to 18 pairs as usually set.

The Standard Sand & Machine Company, Cleveland, O., builds these machines in four sizes, equipping them regularly with floor hopper, revolving screen, elevator boot, bucket and chain elevator, and tempering gear. When desired, a three department proportioning hopper is supplied for controlling the amount of old sand, new sand, and dry binder; also a pump for liquid compounds. With the single hopper type, the materials are assembled in proper proportions before delivering to the hopper. With the three or more department hopper, the correct proportions are fed into the elevator boot from each hopper, and it is only necessary to keep the hoppers well supplied. The proportioned materials are delivered to the mixer by means of the bucket and chain elevator, and there the tempering liquids are introduced. The mixture is carried forward by the worm mixture to the feed end of the revolving drum which is provided with buckets inside to deliver the sand to the rolls within the drum. The pitch of the drum carries the mixture forward regularly so that all the sand is treated alike, and is discharged after being thoroughly rolled and blended.

One roll is stationary while the other is set against heavy compression springs which are adjustable. Sand rolled in this way is not ground into dust, and retains its grain thereby helping toward a perfect vent which is so essential. The machine is modern in every respect, steel gears, bronze bushed bearings, and steel roller bearing chains being used.

The three larger sizes are particularly suited for steel foundries. Fig. 2 shows the arrangement of these, the compression springs back of the adjustable rolls being clearly seen. One pair of rolls

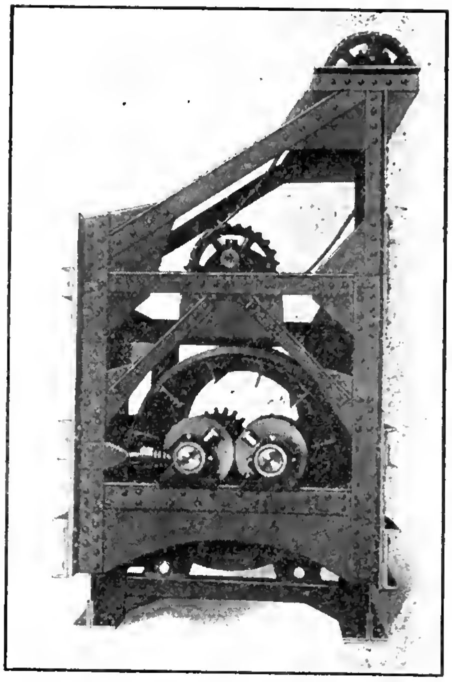


FIG. 2. SPECIAL SAND MACHINE FOR STEEL FOUNDRIES.

arranged in this manner will do the work of tandem or multiple rolls as the material can be passed through the same pair 9 to 36 times. These machines are designed to take the place of wet pan mills for core or facing sands.

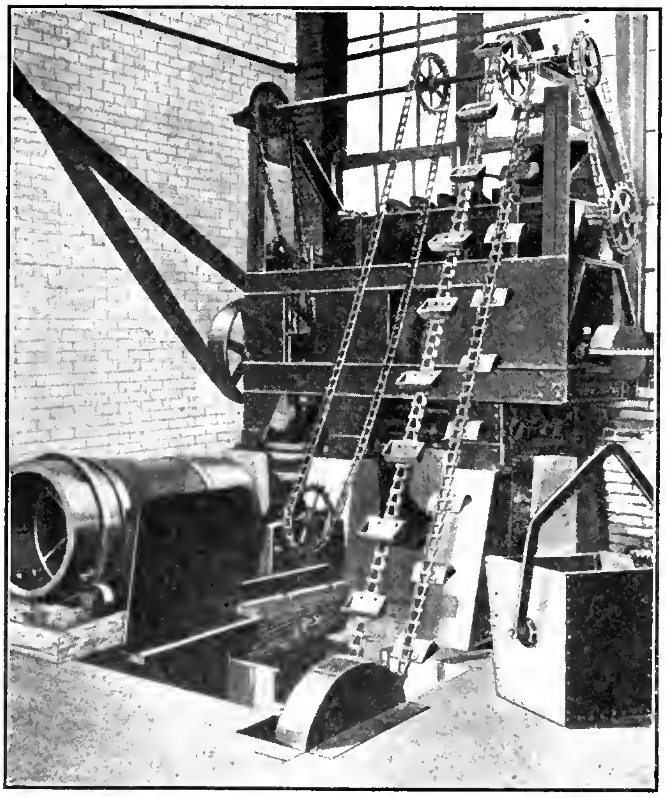


FIG. 1. MIXING, ROLLING AND BONDING MACHINE.

The No. 1 machine has a capacity of 160 cu. ft. per hour, with 10 horse-power; rolls 8 in. dia. x 4 ft. long; the No. 4 machine has a capacity of 360 cu. ft. per hour, with 20 horse-power; rolls 16 in. dia. x 6 ft. long. Floor space required is 10 ft. x 14 ft. and 15 ft. x 17 ft. respectively.

SMALL PLANTS TO HELP

D. A. THOMAS, representative of Lloyd George, British Minister of Munitions, had a lengthy conference with Sir Robert Borden recently, regarding the question of the manufacture of ammunition and big guns in Canada. Others present were Sir Sam Hughes, Sir Frederick Donaldson and Lionel Hitchens, the two latter being the British representatives who will be added to the reorganized shell commission. A scale of prices which the commission is willing to pay for munitions will be drawn up, and the practice of tendering done away with.

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THE VALUE OF MANUFACTURING RECIPROCITY

JUST how much and just how little of a man's business should be known by his competitors is and always will be a moot question, and though at first sight anyone might be prepared to give a conclusive reply one way or the other, there are many qualifying features which prevent the average manufacturer from giving a definite reply offhand.

Apart from its desirability, which is questionable, or its efficiency which is still more questionable, the regime of quasi-secrecy inaugurated in connection with munitions manufacture may have a more or less permanent influence on many of our industrial organizations which must ultimately react to their disadvantage.

The advent of Government work has been characterized in the majority of cases by an absence of that spectacular display of industrial accomplishment which in ante-bellum days had been developed to a high degree. One result of this suppressed publicity has been to generate a feeling of mysterious importance in many enterprises whose pretensions were previously of a modest nature.

Without in any way detracting from the beneficial influence on the campaign which is to be obtained by keeping the enemy in complete ignorance of the extent of our munitions supply, it might be asked whether our own efficiency as munitions producers is not reduced as a result of excessive reticence regarding methods of production.

There are some persons who, in war time as in peace, look upon all journalists as necessary evils, to be borne with when necessary, and avoided when possible. Such individuals fail to realize that in standing in other people's light they also stand in their own.

No man is a hero to his valet, and few firms indeed are so highly regarded by all of their employees that they can afford to set themselves up as sphinx-like oracles. That liberty of employment which the North American workman cherishes as his inalienable birthright is one of the greatest factors in nullifying any attempts to form an Industrial Secrets Trust.

Ever since the munitions industry began to assume national proportions, we have consistently advocated, and devoted our efforts to the judicious dissemination of such technical and manufacturing information as could be of greatest immediate value to the numerous entrants into the ranks of producers. The knowledge that these efforts have not been valueless to many firms is our reward, and the manner in which nearly every concern has placed their experience at the disposal of others is proof of the soundness of our policy.

In another part of this issue we are privileged to place on record a few examples of extreme resourcefulness and development in specialized manufacturing, these being probably only some of many instances of improvised equipment throughout the country. Although the intrinsic value of such efforts may be confined to the originators, the ultimate suggestive value to manufacturers as a body may be very great, and wonderful possibilities may await designers and mechanics as the result of being thus jolted out of the rut of conventional design.

Reference might here be made to an instance in shell manufacture which emphasizes the service rendered by technical journals. In machining 3.3 inch shrapnel forgings, it was found necessary to make the wall of increasing thickness for a short distance near the mouth so as to provide ample metal for the internal thread after nosing in. When the making of 4.5 inch shells was being started, many makers spent a great deal of valuable time in ascertaining the proper taper to allow for the same operation. Meantime a new producer who was not bound by precedent, went ahead and dispensed with the taper, getting satisfactory results with one operation less. The fact that others were experiencing trouble by a too strict adherence to existing methods, did not increase the value of his own method to himself personally, while the lack of just such information delayed their progress perceptibly, besides giving rise to a feeling of disappointment, due to the absence of prompt and successful results.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey forge, Pittsburgh		$14 70
Lake Superior, charcoal, Chicago		15 75
Ferro Nickel pig iron (Soo)		25 00
	Montreal.	**Toronto.**
Middlesboro, No. 3	22 00	.....
Carron, special	23 00	.....
Carron, soft	23 00	.....
Cleveland, No. 3	22 00	.....
Clarence, No. 3	22 50	.....
Glengarnock	26 00	.....
Summerlee, No. 1	28 00	.....
Summerlee, No. 3	27 00	.....
Michigan charcoal iron.	26 00	.....
Victoria, No. 1	23 00	20 50
Victoria, No. 2X	22 00	20 50
Victoria, No. 2 plain..	22 00	20 50
Hamilton, No. -	22 00	20 50
Hamilton, No. 2	22 00	20 50

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto..	2.25
Steel bars, f.o.b., Toronto	2.25
Common bar iron, f.o.b., Montreal	2.25
Steel bars, f.o.b., Montreal	2.25
Twisted reinforcing bars	2.25
Bessemer rails, heavy, at mill....	1.25
Steel bars, Pittsburgh	1.35
Tank plates, Pittsburgh	1.35
Beams and angles, Pittsburgh....	1.35
Steel hoops, Pittsburgh	1.50
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.15
Small shapes	2.40
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.90
Structural shapes	1.95
Plates	1.95

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ¼ to ½ in., 100 lb.	$2 35	$2 25
Heads, per 100 lb.	2 55	2 45
Tank plates, 3-16 in.	2 60	2 45

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$12 25	$12 00
Copper, crucible	14 25	13 50
Copper, unch-bled, heavy	14 25	13 50
Copper, wire, unch-bled..	14 25	13 75
No. 1 machine compos'n	11 50	11 50
No. 1 compos'n turnings	10 00	9 50
No. 1 wrought iron	10 00	9 50
Heavy melting steel	8 00	8 00
No. 1 machin'y cast iron	13 50	11 00
New brass clippings....	11 00	11 00
No. 1 brass turnings....	9 00	9 00
Heavy lead	4 50	4 50
Tea lead	$ 3 50	$ 3 50
Scrap zinc	10 50	9 50

W. I. PIPE DISCOUNTS.

Following are Toronto jobbers' discounts on pipe in effect Aug. 27, 1915:

	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
Standard				
¼, ⅜ in.	63	38½	....	....
½ in.	68	47½	....	....
¾ to 1½ in. ..	73	52½	....	....
2 in	73	52½	69	48½
2½ to 4 in ...	73	52½	72	51½
4½, 5, 6 in...	....	....	70	49½
7, 8, 10 in. ...	....	....	67	44½
X Strong P. E.				
¼, ⅜ in.	56	38½	....	....
½ in.	63	45½	....	....
¾ to 1½ in. ..	67	49½	....	....
2, 2½, 3 in. ..	68	50½	....	....
2 in.	....	....	63	45½
2½ to 4 in. ..	....	....	63	48½
4½, 5, 6 in. ..	....	....	66	48½
7, 8 in.	....	....	59	39½
XX Strong P. E.				
½ to 2 in.	44	26½	....	....
2½ to 6 in. ...	....	....	43	25½
7 to 8 in.	....	....	40	20½
Genuine Wrot Iron.				
⅜ in.	57	32½	....	....
½ in.	62	41½	....	....
¾ to 1½ in. ..	67	46½	....	....
2 in.	67	46½	63	42½
2½, 3 in.	67	46½	66	45½
3½, 4 in.	....	....	66	45½
4½, 5, 6 in. ..	....	....	63	42½
7, 8 in.	....	....	60	37½

Wrought Nipples.

4 in. and under	77½%
4½ in. and larger	72½%
4 in. and under, running thread.	57½%
Standard Couplings.	
4 in. and under	60%
4½ in. and larger	40%

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws, 60 &	10%
Sq. Head Set Screws ....65 &	10%
Rd. & Fil. Head Cap Screws......	45%
Flat & But. Head Cap Screws....	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in. N.	70%
Semi-Fin. Nuts up to 1 in.	70%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

METALS.

	Montreal.	Toronto.
Lake copper, carload ...	$20 00	$19 50
Electrolytic copper	20 00	19 25
Castings, copper	19 75	19 00
Tin	37 00	37 00
Spelter	18 00	17 00
Lead	6 15	6 25
Antimony	35 00	35 00
Aluminum	60 00	60 00

Prices per 100 lbs.

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh...	$24 50
Openhearth bilets, Pittsburgh..	25 00
Forging billets, Pittsburgh	34 00
Wire rods, Pitsburgh	31 00

NAILS AND SPIKES.

Standard steel wire nails, base	$2 40	$2 35
Cut nails	2 50	2 70
Miscellaneous wire nails..	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	70-10
Stove bolts	80
Plate washers	40
Machine bolts, ⅜ and less......	65-10
Machine bolts, 7-16 and over	57½
Blank bolts	60
Bolt ends	57½
Machine screws, iron, brass.....	35 p.c.
Nuts, square, all sizes ....4c per lb. off	
Nuts, hexagon, all sizes..4½c per lb. off	
Iron rivets .... 72½ per cent.	
Boiler rivets, base, ¾-in. and larger	$3.75
Structural rivets, as above	3.75
Wood screws, flathead, bright ....85, 10, 7½, 10 p.c. off	
Wood screws, flathead, Brass ....75 p.c. off	
Wood screws, flathead, Bronze ....70 p.c. off	

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Standard. Price. per ft.	Extra Strong, Sizes Ins.	Extra Strong, Price per ft.	D. Ex. Strong, Size Ins.	D. Ex. Strong, Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.....
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....

COKE AND COAL.

Solvay Foundry Coke	$5.75
Connellsville Foundry Coke	5.00
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

COLD DRAWN STEEL SHAFTING.

At mill	40%
At warehouse	30 & 5%

Discounts off new list. Warehouse price at Montreal and Toronto.

MISCELLANEOUS.

Solder, half-and-half	0.22½
Putty, 100-lb. drums	2.70
Red dry lead, 100-lb. kegs, per cwt.	9.65
Glue, French medal, per lb.	0.18
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.18
Benzine, single bbls., per gal.	0.18
Pure turpentine, single bbls.	0.65
Linseed oil, raw, single bbls.	0.74
Linseed oil, boiled, single bbls.	0.77
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Lead wool, per lb.	0.10
Pure Manila rope	0.16
Transmission rope, Manila	0.20
Drilling cables, Manila	0.17
Lard oil, per gal.	0.73
Union thread cutting oil	0.60
Imperial quenching oil	0.35

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto 40%

PROOF COIL CHAIN.

¼ inch	$8.00
5-16 inch	5.35
⅜ inch	4.60
7-16 inch	4.30
½ inch	4.05
9-16 inch	4.05
⅝ inch	3.90
¾ inch	3.85
⅞ inch	3.65
1 inch	3.45

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	60
Carbon over 1½ in.	25
High Speed	
Blacksmith	60
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Centre	25
Pipe Reamers	80

Discounts off standard list.

IRON PIPE FITTINGS.

Canadian malleable, A, 25 per cent.; B and C, 35 per cent.; cast iron, 60; standard bushings, 60 per cent.; headers, 60; flanged unions, 60; malleable bushings, 60; nipples, 75; malleable, lipped unions, 65.

TAPES.

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3.50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$3 00	$2 85
Canada plates, dull, 52 sheets	3 15	3 15
Canada Plates, all bright	4 75	4 50
Apollo brand, 10¾ oz. galvanized	5 75	5 30
Queen's Head, 28 B.W.G.	6 00	5 95
Fleur-de-Lis, 28 B. W. G.	5 75	5 75
Gorbal's Best, No. 28	6 00	6 00
Viking metal, No. 28	5 25	5 25
Colborne Crown, No. 28	5 70	5 80
Premier No. 28	5 10	5 00

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$13 00	....
1¼ in.	13 00	....
1½ in.	13 00	....
1¾ in.	13 00	....
2 in.	13 00	9 25
2¼ in.	14 25	10 50
2½ in.	15 00	11 50
3 in.	19 25	12 25
3½ in.	22 00	14 50
4 in.	27 00	18 50

Prices per 100 feet, Montreal and Toronto.

WASTE.

WHITE.	Cents per lb.
XXX Extra	0 11
X Grand	0 10½
XLCR	0 09¾
X Empire	0 09
X Press	0 08¼
COLORED.	
Lion	0 07½
Standard	0 06¾
Popular	0 06
Keen	0 05½
WOOL PACKING.	
Arrow	0 16
Axle	0 11
Anvil	0 08
Anchor	0 07
WASHED WIPERS.	
Select White	0 08½
Mixed Colored	0 06¼
Dark Colored	0 05¼

This list subject to trade discount for quantity.

BELTING RUBBER.

Standard	50%
Best grades	30%

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50%
Standard	50 & 10%
Cut leather lacing, No. 1	$1.20
Leather in sides	1.10

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	$9.00
¼ in.	6.25
5-16 in.	4.65
⅜ in.	4.00
7-16 in.	4.00
½ in.	4.00

Prices per 100 lbs.

PLATING CHEMICALS.

Acid, boracic	$ .15
Acid, hydrochloric	.05
Acid, hydrofluoric	.06
Acid, Nitric	.10
Acid, sulphuric	.05
Ammonia, aqua	.08
Ammonium carbonate	.15
Ammonium chloride	.11
Ammonium hydrosulphuret	.35
Ammonium sulphate	.07
Arsenic, white	.10
Copper sulphate	.10
Cobalt Sulphate	.50
Iron perchloride	.20
Lead acetate	.16
Nickel ammonium sulphate	.10
Nickel carbonate	.50
Nickel sulphate	.15
Potassium carbonate	.40
Potassium sulphide (substitute)	.20
Silver chloride (per oz.)	.65
Silver nitrate (per oz.)	.45
Sodium bisulphite	.10
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.35
Sodium hydrate	.04
Sodium hyposulphite (per 100 lbs.)	3.00
Sodium phosphate	.14
Tin chloride	.45
Zinc chloride	.20
Zinc sulphate	.08

Prices Per Lb. Unless Otherwise Stated.

ANODES.

Nickel	.47 to .52
Cobalt	1.75 to 2.00
Copper	.22 to .25
Tin	.45 to .50
Silver	.55 to .60
Zinc	.22 to .25

Prices Per Lb.

PLATING SUPPLIES.

Polishing wheels, felt	1.50 to 1.75
Polishing wheels, bullneck	.80
Emery in kegs	.4½ to .06
Pumice, ground	.05
Emery glue	.15 to .20
Tripoli composition	.04 to .06
Crocus composition	.04 to .06
Emery composition	.05 to .07
Rouge, silver	.25 to .50
Rouge, nickel and brass	.15 to .25

Prices Per Lb.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., Oct. 18, 1915.—The manufacture of munitions still retains first place in our metal-working plants. The demand for steel bars and billets continues unabated, and little change otherwise is evident. The various mills are operating right up to capacity, and many of them will be unable to take on further business for delivery this year. Consumers are even having difficulty in placing orders for 1916, as the mills decline to commit themselves for any extended period. As a matter of fact, it is hinted that advanced prices may prevail when they are in a position to take on more business.

Machine Tools and Supplies

The situation in the machine tool trade shows little change over that of the previous week. In some instances the delivery of necessary tools for shell production is being longer delayed, and several plants are meantime handicapped in their operations as a consequence. The demand for supplies continues brisk. However, some concerns who require duplicate machine parts to replace those broken or worn, and which must be procured from the United States, find great difficulty in securing these promptly.

Metals

Prices on the different metals are holding firm. Spelter shows some inclination to drop in price, while aluminum has advanced considerably over the quotations of the last week, being now around 60c.

Old Material

Scrap metals have shown no material change during the week, quotations remaining the same, with the exception of tea lead, which registers a slight increase.

Toronto, Ont., Oct. 19.—Indications point to a return of better trade conditions and a distinctly optimistic tone exists in business circles. The record harvest means prosperity in the West: war orders are keeping many factories fully employed, the adverse trade balance has been eliminated and railroad earnings now show an increase. The steel trade is generally considered to be the barometer of industrial conditions, and in its present state of great activity gives reasonable grounds for hoping that the improvement in business now taking place is something more than temporary. The influx of large sums of money resulting from war orders cannot help but stimulate manufacturing, and with the improvement in Canadian fiscal conditions will lead to a marked industrial development in the country.

Developments in the shell industry are pending and arrangements are being made for the manufacture of shells up to 12 in. calibre. The duties and responsibilities of the Shell Committee have increased to such an extent that a reconstitution of its personnel is being made to meet the demands of the situation. It is understood that the British Government have reserved large orders for shells for Canada, providing quick delivery can be made and at a fair price. A central ordnance factory for making big guns is under consideration: this branch of the industry will also come under the control of the Shell Committee.

Steel Market

The steel trade is in a very buoyant condition and the mills are operating at capacity. The market is very strong and prices on a number of steel products are advancing. Canadian mills are quoting iron and steel bars at 2.25c Toronto. Prices on wire are withdrawn pending a revision, which will be in an upward direction. Pittsburgh bars, plates and small shapes for Canadian business are quoted at 1.35c f.o.b. the mill, but are likely to be advanced again very shortly to 1.40c. The difficulty in obtaining quick delivery on steel products is illustrated by a Canadian buyer recently paying several dollars a ton premium for prompt delivery of structural material.

The placing of orders for larger shells which is anticipated, and the repeat orders for 18-pdr. shells in considerable quantity indicates that the steel companies will be very busy for some time to come. It is understood that the Dominion Steel Corporation have decided to embark on the manufacture of shells and that a large order will be placed with them for those of large calibre. This concern has for some time been actively engaged in producing steel for shells but not turning out the complete product.

The galvanized sheet trade is somewhat unsettled. Although the price of spelter has declined, manufacturers of sheets are hesitating before making any further change since the revision announced recently. The semi-finished steel situation is steadily becoming a factor in the present sheet market. The unusual conditions in sheets have upset the price relationship as between gauges. Galvanizers are asking more for the light gauges of sheets than for the heavy gauges because of the greater amount of spelter required per ton in the former.

All the mills in the States are running to capacity on account of the tremendous buying of all kinds of steel products. Steel for near-by deliveries is almost impossible to get at any price. The heaviest demand is for round bars and blooms for shells. Prices are advancing, no business being placed for bars at less than 1.40c Pittsburgh. Forging billets have advanved $1 per ton and are now being quoted at $34 base, f.o.b. Pittsburgh. Prevailing prices on wire are strong, and it is not improbable that quotations will be put up $1 or $2 per ton in the near future.

Pig Iron

The chief interest in the market is in steel making grades, with low-phosphorous iron still the feature. Canadian buyers have taken considerable tonnage from the States. Among these is the Canadian Steel Foundries, who have bought 7,000 tons recently and have inquired for 5,000 tons additional, the price being $25 at the furnaces. Foundry grades are quiet at unchanged prices.

Machine Tools

Machine tool dealers are anticipating a period of considerable activity in the near future when it is expected that the orders for the larger calibre shells will be ready to be placed. A few tentative inquiries have already been received for large size lathes, but up to the present few orders have been given out. The great problem at present as regards new equipment is the question of delivery. Builders are in a sold-up condition and the supply of suitable second-hand tools is rapidly decreasing.

Supplies

The demand for machine shop and mill supplies continues good and prices are holding very firm. Prices of high-speed twist drills are withdrawn on account of the continued advance in high-speed steel. In regard to the latter, the situation shows no improvement and prices are away up; supplies in sufficiently large quantities are also still difficult to obtain. Prices of waste are very firm but unchanged. Turpentine has advanced 1c and is now quoted at 65c per gallon.

Metal Market

The metal market is dull and there is little of interest to note. Tin and spelter are lower, but aluminum has advanced. The copper market is steady as a result of good demand for war munitions which shows no signs of abatement. The lead market is unchanged, but the position of this metal is a good one. There is still some scarcity in supplies of antimony, but the demand has not improved and quotations are stationary. Prices of solders are unchanged, but have a weak

tendency due to tin having declined. There is no change locally in the general situation. The general trend of business continues the same, metal for munitions constituting the principal demand.

Tin.—The market is quiet and lower, and comparatively little interest is being shown by consumers. The one influence dominating the tin market in New York is the expectation that the British Government will impose a 10 per cent. tax on its importation; there is as yet no official confirmation of any such intention. No large business is looked for until that question is settled, as consumers are content to wait. Tin has declined 1c locally and is quoted at 37c per pound.

Copper.—The market is very dull, but prices are holding firm. Buyers have fair stocks on hand, but are reaching a point where they will have to take on additional supplies. Producers are well stocked up, but are not inclined to offer any price concessions. Quotations are steady and unchanged at 19½c per pound.

Spelter.—The market for spot is weaker owing to the absence of interest on the part of consumers. Another influence lending weakness was a decline in the London market. Spelter has declined 1c locally, and is quoted at 17c per pound.

Lead.—The market is quiet and unchanged. It is reported that Canadian consumers have closed contracts for some good amounts of lead in addition to those recently placed. Quotations are firm at 6¼c per pound.

Antimony.—There is no change in the situation and the demand does not show much improvement. Quotations are unchanged at 35c per pound.

Aluminum.—Supplies are diminishing and the demand is increasing heavily, due to war orders. Quotations have reached a record level and are nominal at 60c per pound.

LOOKING FOR NICKEL

VICKERS, LTD., the well-known armament manufacturers, are financing an exploration expedition to the Fond du Lac region lying northeast of Lake Athabasca, in northern Alberta, in search of nickel deposits which are believed to occur extensively in that country.

Some months ago H. V. Dardier, a prospector, returned from Fond du Lac with rich specimens of nickel ore and went to England in order to interest British capitalists. He has been placed in charge of the expedition, which is on a large scale, comprising 25 engineers, assayers and mineralogists in addition to a large force of laborers.

They take with them machinery valued at $50,000 and supplies costing $10,000, being prepared for a long stay in order to thoroughly prospect the region. The total cost of the enterprise will amount to fully $100,000.

CANADIAN COMMERCIAL INTELLIGENCE SERVICE

The Department of Trade and Commerce invites correspondence from Canadian exporters or importers upon all trade matters. Canadian Trade Comissioners and Commercial Agents should be kept supplied with catalogues, price lists, discount rates, etc., and the names and addresses of trade representatives by Canadian exporters. Catalogues should state whether prices are at factory point, f.o.b. at port of shipment, or, which is preferable, c.i.f. at foreign port.

CANADIAN TRADE COMMISSIONERS.

Argentine Republic.

H. R. Poussette, 278 Balcarce, Buenos Aires. Cable Address, Canadian.

Australasia.

D. H. Ross, Stock Exchange Building, Melbourne, Cable address, Canadian.

British West Indies.

E. H. S. Flood, Bridgetown, Barbadoes, agent also for the Bermudas and British Guiana. Cable address, Canadian.

China.

J. W. Ross, 6 Kinkiang Road, Shanghai. Cable Address Cancoma.

Cuba.

Acting Trade Commissioner, Lonja del Comercio, Apartado 1290, Havana. Cable address, Cantracom.

France.

Philippe Roy, Commissioner General, 17 and 19 Boulevard des Capucines, Paris. Cable address, Stadacona

Japan.

G. B. Johnson, P.O. Box 109, Yokohama. Cable Address, Canadian.

Holland.

J. T. Lithgow, Zuidblaak, 26, Rotterdam. Cable address, Watermill.

Newfoundland.

W. B. Nicholson, Bank of Montreal Building, Water Street, St. John's. Cable address, Canadian.

New Zealand.

W. A. Beddoe, Union Buildings, Customs Street, Auckland. Cable address, Canadian.

South Africa.

W. J. Egan, Norwich Union Buildings, Cape Town. Cable address, Cantracom.

United Kingdom.

E. de B. Arnaud, Sun Building, Clare Street, Bristol. Cable address, Canadian.

J. E. Ray, Central House, Birmingham. Cable address, Canadian.

Acting Trade Commissioner, North British Building East Parade, Leeds. Cable address, Canadian.

F. A. C. Bickerdike, Canada Chambers, 36 Spring Gardens, Manchester. Cable address, Cantracom.

Fred. Dane, 87 Union Street, Glasgow, Scotland. Cable address, Cantracom.

Harrison Watson, 73 Basinghall Street, London, E.C., England. Cable address, Sleighing, London.

CANADIAN COMMERCIAL AGENTS.

British West Indies.

Edgar Tripp, Port of Spain, Trinidad. Cable address, Canadian.

R. H. Curry, Nassau, Bahamas.

Colombia.

A. E. Beckwith, c-o Tracey Hmos, Medellin, Colombia. Cables to Marmato, Colombia. Cable address, Canadian.

Norway and Denmark.

C. E. Sontum, Grubbeged No. 4, Christiania, Norway. Cable address, Sontums.

South Africa.

D. M. McKibbin, Parker, Wood & Co., Buildings, P.O. Box 559, Johannesburg.

E. J. Wilkinson, Durban, 41 St. Andrew's Buildings, Durban, Natal.

CANADIAN HIGH COMMISSIONER'S OFFICE.

United Kingdom.

W. L. Griffith, Secretary, 17 Victoria Street, London, S.W., England.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Kingston, Ont.—Davis & Son contemplate installing equipment in their power house.

Owen Sound, Ont.—The Owen Sound Ironworks are equipping their plant for making shells.

Welland, Ont.—It is reported that preparations are being made to reopen the plant of the Canadian Steel Foundries.

Owen Sound, Ont.—The Canadian Malleable Iron Co., will install equipment for making high explosive shells.

Port Moody, B.C.—The Port Moody Steel Works is contemplating the erection of a plant to cost upwards of $100,000.

Calgary, Alta.—The Alberta Hydro-Electric Power Co. will build a power plant here. Ald. Fawkes is consulting engineer.

Jacksonboro, Ont.—The Mattagami Pulp & Paper Co. will commence at once the erection of pulp and paper mills at Smooth Rock Falls, on the Mattagami River, near here, to cost $2,000,000.

Bay of Islands, Nfld.—Joseph Salters & Sons, of North Sidney, C.B., have applied for permission to develop water powers near here.

Walkerville, Ont.—The Canadian Duplex Steam Trap Co., which was recently incorporated with a capital of $40,000, will establish a plant here.

Pembroke, Ont.—Thomas Pink Co. are installing new machinery for making shells. The new plant will be a duplicate of the original one and will double the company's output.

Kingston, Ont.—A. Davis & Son are in the market for one 125 to 150 h.p. Wheelock engine; one 100-kw., 550-volts, 60-cycle, 3-phase alternating current generator, and one 100-kw. direct-connected, 550-volts, 60-cycle, 3-phase alternating current generator set.

Merritt, B.C.—The British Columbia Copper Co. proposes to spend in the neighborhood of $500,000 in the erection of a concentrating plant at their Copper Mountain properties. This is to be operated by an electric power plant to be erected either at Princeton or Tulameen, according to reports, it being estimated that it will take at least $300,000 to erect and equip same.

Ottawa, Ont.—An important new factory for the manufacture of munitions of war is to be established at Renfrew, Ont., entitled, "O'Brien's Munitions, Ltd." The company was incorporated last week with a capital stock of two million dollars. It is understood that M. J. O'Brien, the well-known contractor, is the leading spirit in the enterprise, and that his investment will be half a million dollars.

CANADIAN GOVERNMENT PURCHASING COMMISSION

The following gentlemen constitute the Commission appointed to make all purchases under the Dominion $100,000,000 war appropriation:—George F. Galt, Winnipeg; Hormidas Laporte, Montreal; A. E. Kemp, Toronto. Thomas Hilliard is secretary, and the commission headquarters are at Ottawa.

ALLIES PURCHASING AGENTS

The Trade and Commerce Department, Ottawa, has published the following list of purchasing agents for military purposes for the allied Governments:

International Purchasing. Commission, India House, Kingsway, London, Eng.

French.—Hudson Bay Co., 56 McGill Street, Montreal; Captain Lafoulloux, Hotel Brevort, New York; Direction de l'Intendence Ministere de la Guerre, Bordeaux, France; M. De la Chaume, 28 Broadway, Westminster, London.

Russian.—Messrs. S. Ruperti and Alexsieff, care Military Attache, Russian Embassy, Washington, D.C.

Municipal

Winnipeg, Man.—By a vote of 104 to 64 the ratepayers of Assiniboia defeated the $27,000 incinerator by-law on Oct. 9.

Port Coquitlam, B.C.—A by-law has been passed by the ratepayers to raise $35,000 for the purpose of installing a civic water system.

St. Andrews, N.B.—The Town Council propose making extensions to the waterworks system at a cost estimated between $20,000 and $30,000.

St. Agathe des Monts, Que.—A sewage system will be installed here which will include a pumping station. Ouimet & Lesage of Montreal are the engineers.

Watrous, Sask.—A by-law will be voted on by the ratepayers on Oct. 26 to authorize the expenditure of $49,423 for the construction of a waterworks system.

Niagara Falls, Ont.—It is proposed to spend $14,000 on the purchase of the machinery and equipment of the city electric power station. A by-law will be submitted on November 3.

Whitby, Ont.—A macadamized road 26 miles in length, to cost $310,000, was recommended by Provincial Highways Engineer W. A. Maclean at a meeting of the Kingston Road Improvement Committee here, on Oct. 14. Representatives were present from all the towns and townships interested, also Controller Foster and Commissioner Harris from Toronto, which is backing the project.

Mimico, Ont.—Contracts for the new sanitary system of Mimico and New Toronto were awarded on Oct. 8 at a special meeting of the commission recently appointed. Harvey, Stewart & Co., of Nova Scotia, were the successful bidders for the construction of the sewage system, at the figure of $64,493. F. F. Frue, of Toronto, will build the disposal plant, the estimate being $15,253, and the Dominion Sewer Pipe Co. was awarded the contract for the vitrified pipes and segment blocks used in the system.

General Industrial

Guelph, Ont.—Fire on Oct. 14 did $15,000 damage to the Colonial Knitting Co. plant here.

Lindsay, Ont.—Horn Bros. have not completed arrangements for the rebuilding of their factory.

Vernon, B.C.—R. J. Graham & Co., of Belleville, Ont., will build a factory here for evaporating vegetables.

Halifax, N.S.—The Nova Scotia Underwear Co. mills at Eureka, were totally destroyed by fire on Oct. 13. The loss is covered by $150,000 insurance.

Systematized Shell Production: Methods and Results

Staff Article

Efficient teamwork by any organization is only possible when a clear and complete understanding exists between all members. Frequent conferences between responsible parties for open discussion of common problems, effectively prevents subsequent delays due to overlapping or failure of any particular department to maintain scheduled output.

SHELL making in Canada has now reached the stage where it might seem impossible to further enlighten those interested in any way, with the manufacture of these munitions of war. While this may be true regarding the various operations required to produce the completed shell, the system whereby these operations are performed and the methods devised are often so different, and correspondingly interesting, that a great deal can yet be said on the methods adopted in the various plants.

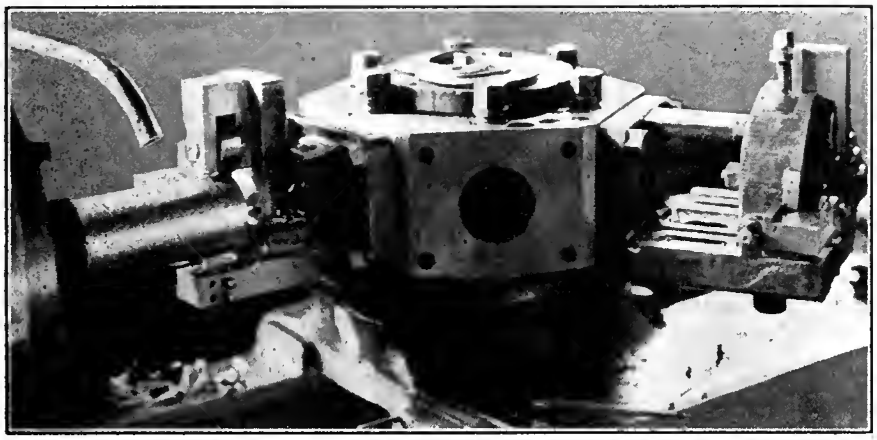


FIG. 1—OUTSIDE ROUGH TURNING ON "LIBBY" TURRET LATHE

It is strangely true that no two men think alike, and it is also true that no two shops (even if they are producing the same class of goods) are similarly equipped. It is, therefore, reasonable to expect, when the same proposition is placed before a number of men, each surrounded by his own individual requirements and experience, that the final solution to the same problem—while having the same answer—may vary to such an extent in detail, as to appear entirely different. It is this variation in detail that is constantly keeping the attention of the readers of trade papers in close touch with the many ingenious methods and devices which are being adopted for the maximum output of this much needed article.

While there has been quite a number of plants specially constructed for the manufacture of 3.3 and 4.5 shells, there are a far greater number who have taken the opportunity of the times and equipped their present factory with the necessary tools for producing these shells.

In the present situation, when the desired tools are practically unobtainable, much thought and consideration have been given to the designing and developing of jigs and attachments, whereby the present equipment (often of ancient origin) can be used to the best advantage.

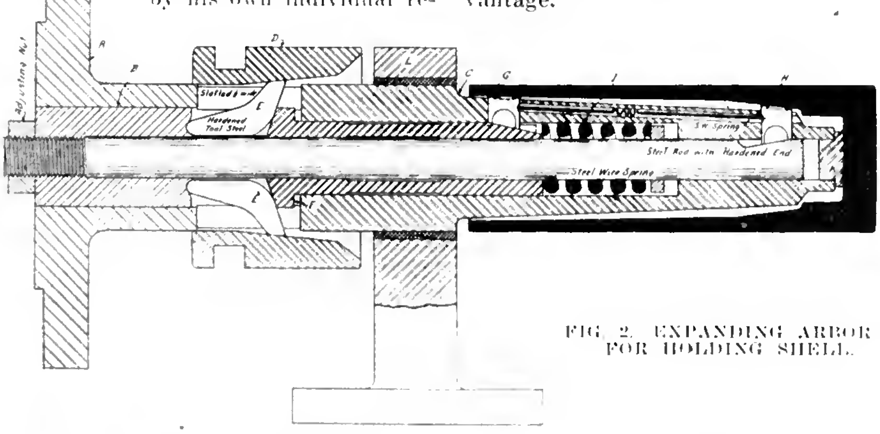


FIG. 2. EXPANDING ARBOR FOR HOLDING SHELL.

Plant Organization

When the plant herein described, first considered the manufacture of shells, every detail was carefully considered before the actual work was commenced. One of the chief features in this connection was the organization of a private shell committee, composed of the manager, superintendent and foremen of the various departments. From the commencement of operations this committee has met regularly to discuss ways and means whereby the production of shells can be handled to the best advantage. The success of this firm, in producing shells of first-class quality, is largely due to the methods of co-operation among the members of this committee. Suggestions and ideas are here advanced and every detail carefully considered before any actual work is performed.

That this method of solving the problems of shell making has met with satisfactory results, is shown in the report, that this firm have one of the best records of any in Canada. The efficiency, in series of 120 has averaged 117, and in some cases 118, which is practically perfect. In consideration of this showing

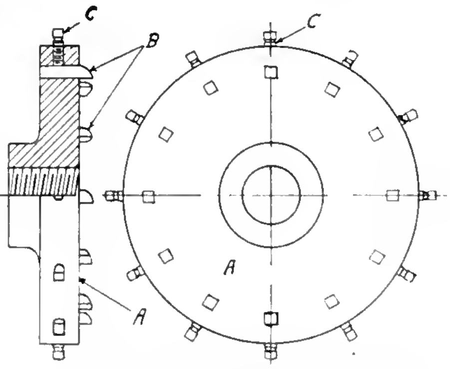


FIG. 1A. CUTTER FOR FACING OFF SHELL BASES.

they are now making series of 250 in place of the ordinary quantity of 120.

In addition to the good showing being made in production, this firm have designed and installed several novel and useful attachments in connection with the manufacture of shells which have proved highly satisfactory; some of these devices are now being used by other plants with excellent results.

Shell Production

The sequence of operations in this plant is somewhat similar to that in other establishments; however there are several very interesting devices that are worthy of description.

Roughing to Length

The open end of the forgings are cut off in a Hall cutting off machine and the

base is faced off on a Bertram 20-inch gap lathe; the shells are held in a jig on the saddle while a home-made milling cutter, similar to Fig. 1A is used for facing the end. Another Bertram 20-inch shafting lathe is also being fitted up to perform this operation.

Outside Rough Turning

The outside rough turning is accomplished on three single spindle Jones & Lamson flat turret machines, and one Libby turret lathe. A view of the operation on the Libby lathe is shown in Fig. 1. The shell is held on the expanding arbor shown in Fig. 2. The flange A is secured to the chuck or face plate of the lathe. Within this piece is the steel regulating bush B, which is held in position by a nut at the back. Secured to flange A is the cast steel arbor C, which carries the expanding mechanism. When the rough shell has been placed on the arbor, sliding sleeve D is advanced by means of a lever; the internal tapered slots in this piece now act upon the three dogs E, which force the hardened steel bush F forward and pull the central rod backward; the hardened steel dogs G and H are thereupon forced outward by tapered grooves formed in bush F, and the rod end respectively. These dogs are arranged in groups of three and centralize the forging very accurately.

After the shell has been turned sleeve D is moved back, when the spring I acting on the bush F and a steel collar fastened to the shaft, causes a relative movement between the bush and the shaft, removing the pressure on the end of the dogs G and H, whereupon they contract and allow the shell to be removed. A hardened steel plug is placed in the end of the arbor to gauge the lateral position of the shell. To insure rigidity the steady head L is used; this is made of cast iron with a babbited bearing.

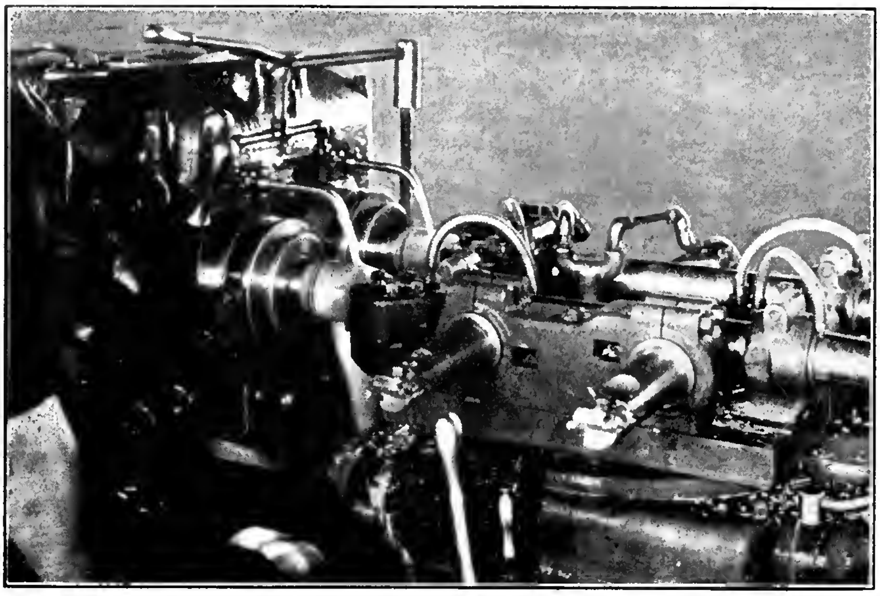


FIG. 3—INSIDE BORING ON JONES & LAMSON DOUBLE SPINDLE FLAT TURRET LATHE

Inside Boring

The inside boring is done on four Jones & Lamson double spindle flat turret lathes, the operation being shown in Fig. 3. After the shells are bored the driving band groove is formed on an 18-inch Bertram lathe with Bertram waving and undercutting attachments.

Hardening and Tempering

The hardening of the shells which is done in much the same way as already described in previous articles is shown in Fig. 4 The furnaces used are two of Dominion Bridge Co. make, while four others are being installed. The oil bath is placed inside a larger tank which gives a space about 10 inches completely around it; this space is filled with cooling water which is in continual circulation. In addition, the oil is further cooled by being pumped through a suitably arranged cooling tank. After the shells have been tempered they are placed in line to give sufficient annealing for further machining.

The scale and lime is then brushed off and the part of the base diameter back of the copper band groove is ground to size.

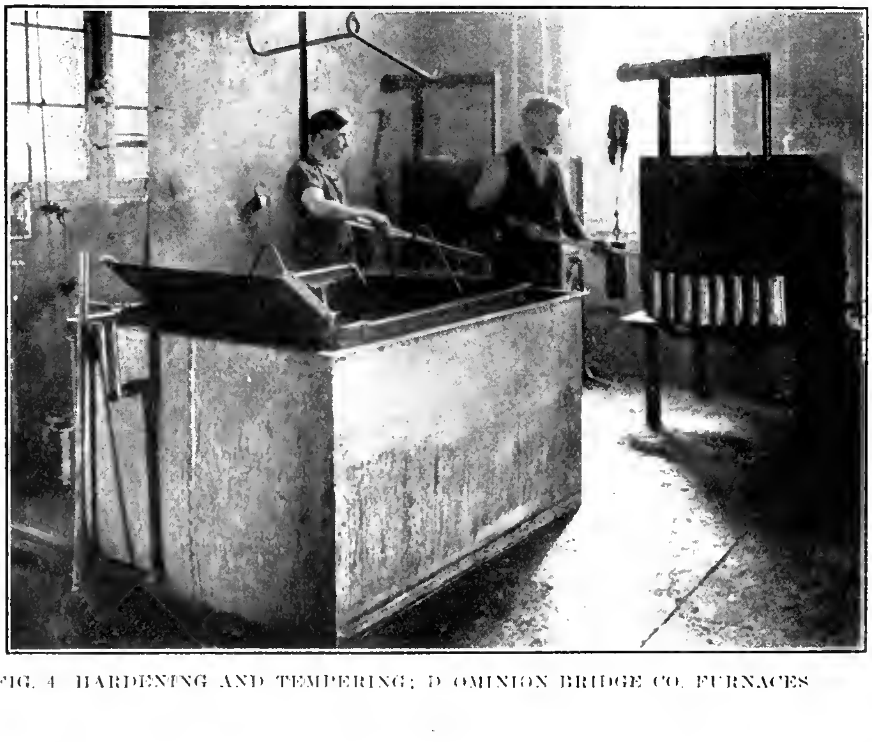


FIG. 4 HARDENING AND TEMPERING; DOMINION BRIDGE CO. FURNACES

Nosing

The nose is now heated in a lead bath to a temperature of about 1,500 degs. F., and formed to shape in a Brown-Boggs No. 320 A geared straight side press.

The nose of the shell is finished in three Jones & Lamson single spindle flat turret lathes. The profile of the outside is formed, the nose bored and threaded, internal profile formed and the end beveled. A sizing tap is then run in by hand.

Grinding and Cleaning

The body diameter and nose are then ground to final size and shape in four Ford-Smith grinders. After the shells are thoroughly cleaned they are stamped in a Brown-Boggs stamping machine.

Putting on Copper Band

The copper bands are pressed on in a 150-ton hydraulic press constructed by the Lymburner Co., of Montreal. A sketch of this press is shown in Fig. 5. This press was designed to operate with a maximum pressure of 1,500 lbs. per sq. inch. To avoid any excess pressure taking effect upon the shell (which would have a tendency to distort it) a relief valve, set to open at the desired limit of pressure was placed on the feed pipe at one of the hydraulic connections as shown at A.

The sectional view of Fig. 5 shows very clearly the detail construction of this press. Oil is used for operating the press and is supplied by pressure pump shown in Fig. 6. The fluid passes through the 3/8 inch pipes B and enters the space between the pistons C and the movable cylinders D. As the pressure risest o 1,500 lbs. per sq. in., it is transmitted to the area of the piston, which is $6.5^2 \times .7854 =$ 33.18 sq. inches.

At a pressure of 1,500 lbs. per square inch this gives a total pressure acting on each cylinder of $1,500 \times 33.18 =$ 49,770 lbs., or about 25 tons. This pressure is transmitted through the die blocks E to the copper band. The coil springs F are to force the cylinders back after the fluid has been released.

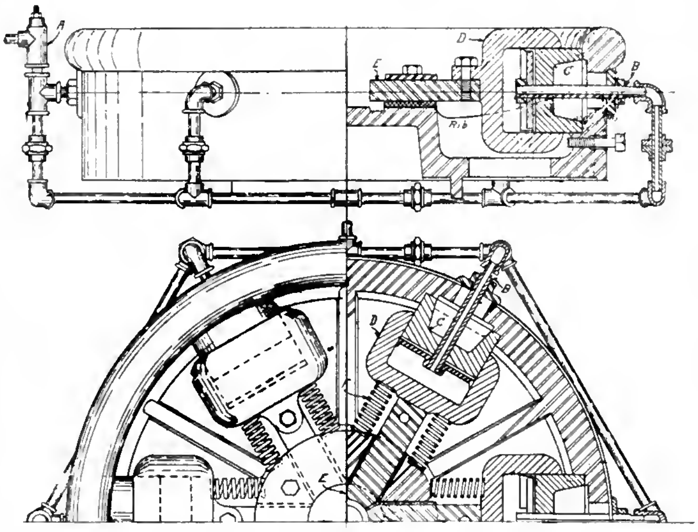


FIG. 5. "LYMBURNER" HYDRAULIC PRESS, 150 TONS CAPACITY

Pressure Pump

The pressure pump—which supplies fluid to this press—also designed and constructed by the Lymburner Co., is shown in Fig. 6; this pump, which is of the duplex type, has two plungers of 7/8 inch in diameter and a stroke of 2 inch. The fluid is drawn from the reservoir A, through the check valve B, up through the pipe C and into the cylinder chamber D, during the intake stroke of the plunger. The discharge stroke of the plunger forces the fluid through the supply pipe E to the six cylinders of the press. When the pressure has reached 1,500 lbs. per sq. inch on the gauge the controlling lever is released and the fluid passes back into the reservoir A.

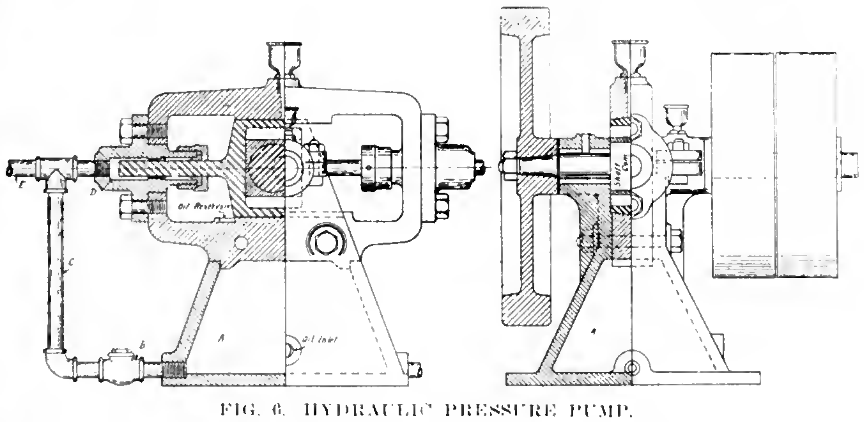


FIG. 6. HYDRAULIC PRESSURE PUMP.

Copper Band Turning

After the driving band has been pressed on the shells are taken to a Rahn & Carpenter 16-inch lathe shown in Fig. 7. The device here shown is the Lymburner copper band turning attachment. Besides this special turning device there are some other interesting contrivances to be seen here. One of these is a special draw-in collet chuck operated by the toggle gear described below, which has been successfully adapted for use on several of the machines used throughout the factory.

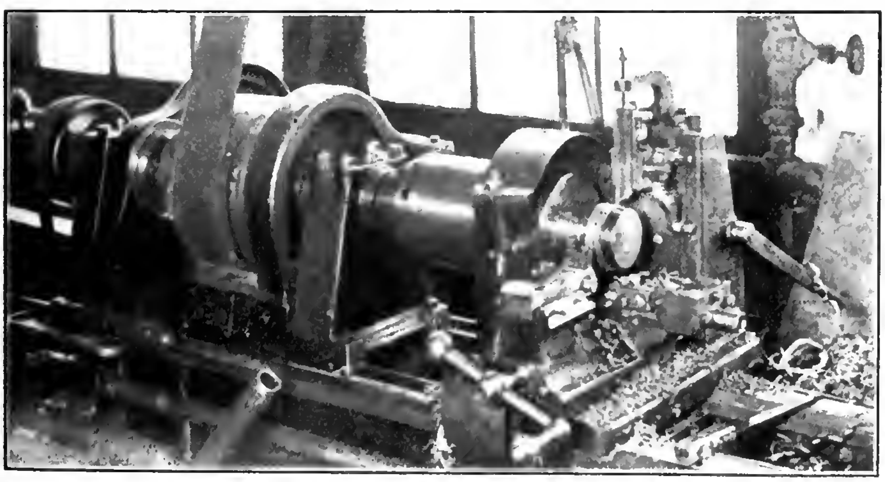


FIG. 7 TURNING COPPER BANDS

Special Chuck

The details of the chuck (designed and constructed in the shop), which is used on a numof machines, is shown in Fig. 8. The body of the chuck A is threaded to fit the screw on the lathe spindle and turned on interior to the desired dimensions, to receive the split collet B. Inside of this split collet is another split bush C, turned to fit the collet B and ground out (when in position) to fit the diameter of the finished shell; this inner bush is held in position by two screws D, which pass through slots in the collet B. This allows the collet B to be moved laterally by means of the rod E, which connects with the toggle arrangement at the rear of the lathe spindle.

Toggle Arrangement

The toggle arrangement is shown in detail in the sketch Fig. 10. This device which has displaced the hand wheel previously used was also designed and installed by the superintendent of the shop and is proving very efficient.

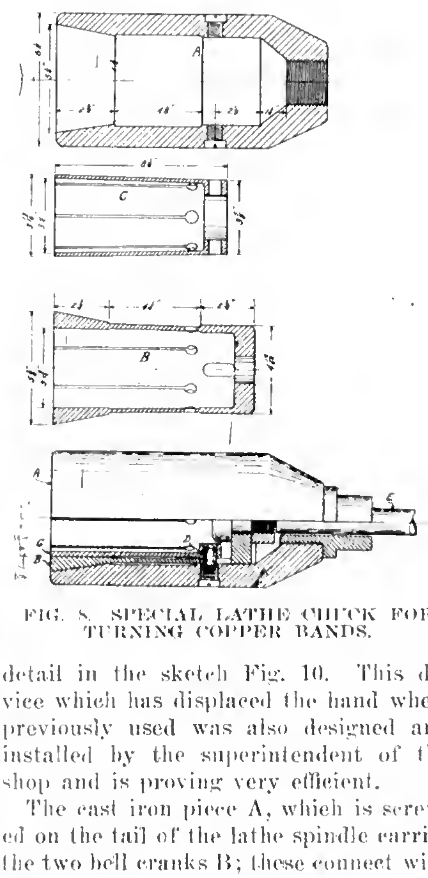
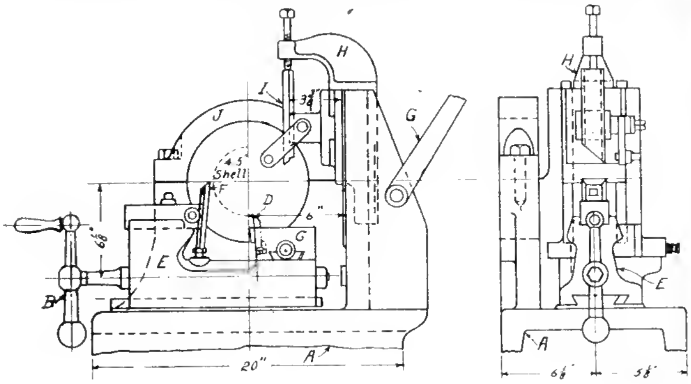


FIG. 8. SPECIAL LATHE CHUCK FOR TURNING COPPER BANDS.

The cast iron piece A, which is screwed on the tail of the lathe spindle carries the two bell cranks B; these connect with the sliding collar C, by means of the links D. The short arm of the bell cranks B fits into a groove in the adjustable col-

lar E, which controls the grip upon the chuck. The slotted end of the lever F works on the pin of a steel ring G; the collar C revolves freely, lateral play be-



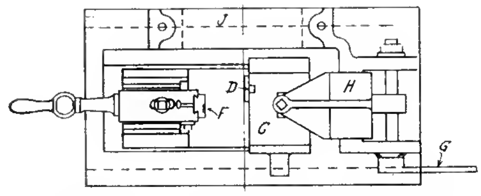


FIG. 9. "LYMBURNER" COPPER BAND TURNING ATTACHMENT.

ing adjusted by the nut H. The bracket I, which is secured to the bed of the lathe, carries the arm F, and likewise supports the outer end of the rod J.

Band Turning Device

Fig. 9 shows a sketch of the Lymburner band turning attachment which has been doing excellent work in the finishing of the copper rifling band, on 3.3 and 4.5 British shells and also French and Russian. The frame A of the device is secured to the shears of the lathe in the desired position. By turning the handle B, the slide C with tool D travels in a direction parallel with the lathe spindle; this is obtained by means of a pair of spiral gears beneath the slide C. The tool D is in such a position that the copper is roughed off with a single point tool.

While the tool D is roughing the band off, the slide E and tool F are advancing toward the work; when the roughing is finished the forming tool F shapes the band. Lever G is then pulled forward and by action of the pinion and rack, the slide H is forced down, and the tool I sizes and polishes the copper band. The part of the frame J acts as a steady head.

Assembling

Fig. 11 shows the assembling bench. The brass tube is screwed into the diaphragm and the shell filled with bullets and jarred with an air vibrator; they are then filled with resin from the two electric heated furnaces shown at either end of Fig. 11. The man at the right of the figure paints the brass sockets with red lead and enters it into the nose of the shell; it is then passed across to the man in the centre who places the shell in a special machine shown in Fig. 12, where the socket is screwed home by the power supplied by the machine. After the socket is screwed in the shells pass to a lad at the end of the bench where the tubes are soldered with two electric irons; from here they go to the machine shown in the background of Fig. 11, where the sockets are finish turned. The arrangement here is so compact that the shells pass from one operator to the other without the men taking more than one step.

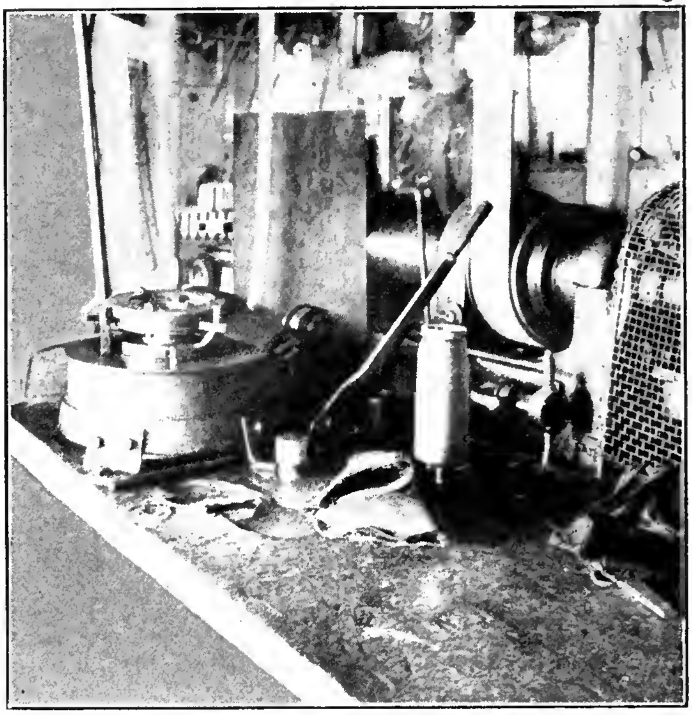


FIG. 12 -SCREWING IN SOCKETS WITH SPECIAL DEVICE

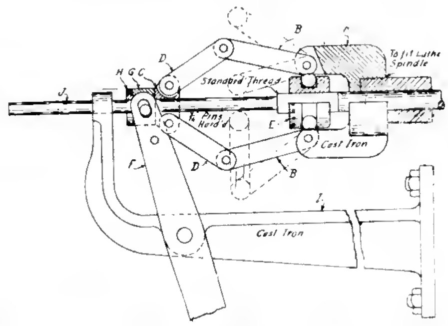


FIG. 10. TOGGLE JOINT FOR LATHE CHUCKS.

Socket Screwing Machine

The details of the socket screwing machine (designed and built by the Lymburner Co.) are shown in Fig. 13. The frame A of the machine is secured to the bench; this casting is bored to receive the split collet B, which is operated by the rod C as shown. This arrangement of the handwheel has been displaced by the toggle device described above, which gives better satisfaction, with increased production. The copper band, being of a larger diameter than the body of the shell, it is necessary to place an auxiliary bush over the shell before placing in the chuck.

On the outer diameter of the centre casting A is placed the large worm gear D, which meshes with

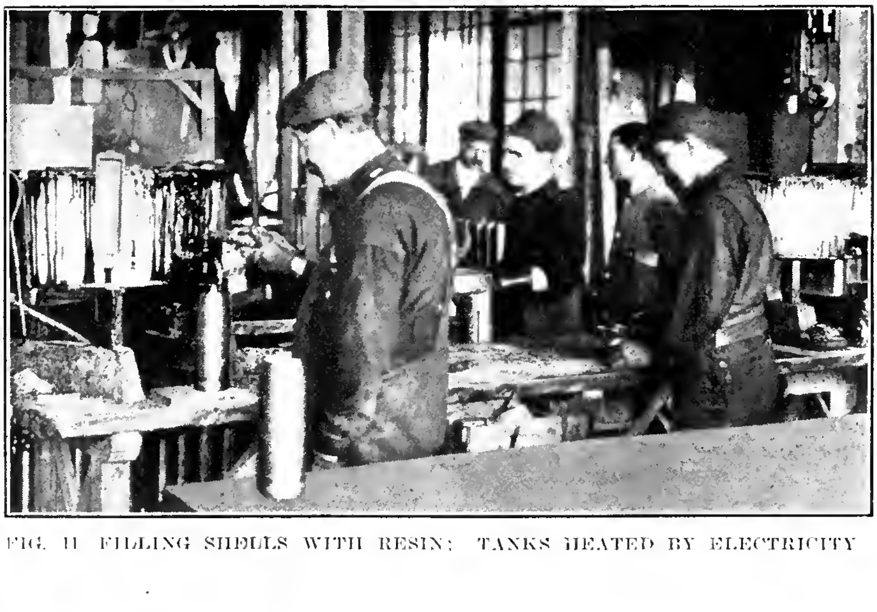


FIG. 11 FILLING SHELLS WITH RESIN; TANKS HEATED BY ELECTRICITY

the worm E. The shaft F, upon which the worm is secured, runs in brass bushes held in the housing of the frame A. The end thrust is taken up by the fibre collars shown, the position of which can be adjusted by the threaded brass bushes. The driving pulley G is keyed to the end of the shaft F. Varying force can be applied to the screwing arrangement by means of the idler pulley H, which revolves on a pin secured in the arm I; on the opposite end of the shaft that carries the

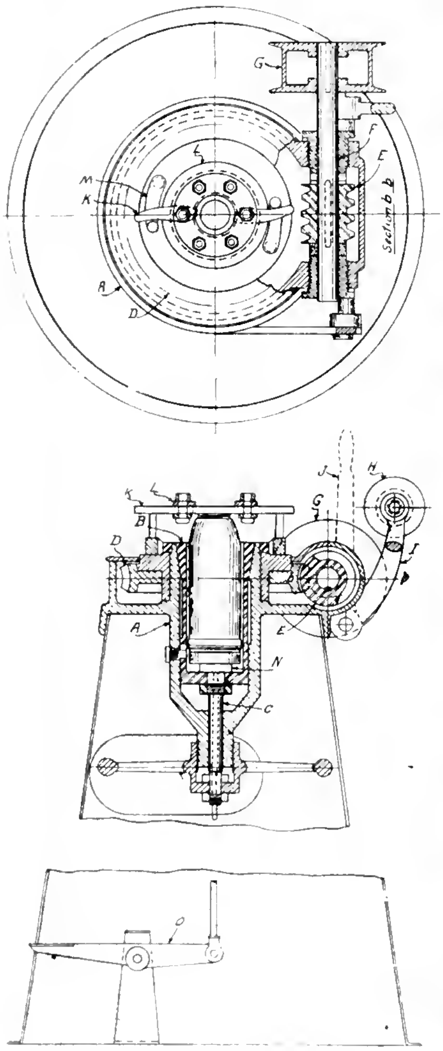


FIG. 13. SPECIAL APPARATUS FOR SCREWING IN BRASS SOCKETS.

arm I is the lever J, which controls the tension put upon the belt. In preference to the two-point driving arrangement shown in Fig. 13, a three-point drive is now being used. The dogs K, with teeth on the inner end, are pivoted on studs in the collar L. These dogs come in contact with self adjusting bell cranks M mounted in the worm gear.

Operation

The operation is as follows: the slip bush is placed over the shell and placed in the chuck and resting on the ejector

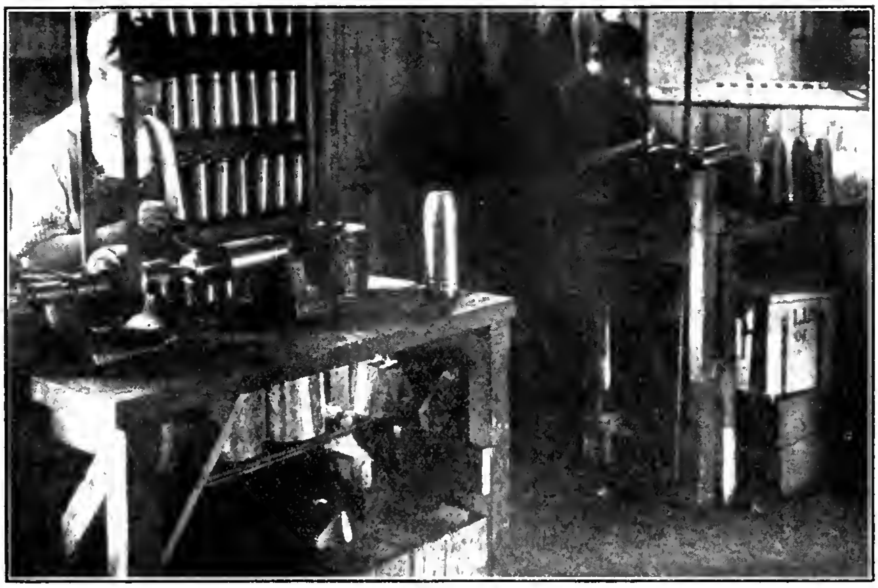


FIG. 14. PAINTING AND DRYING SHELLS.

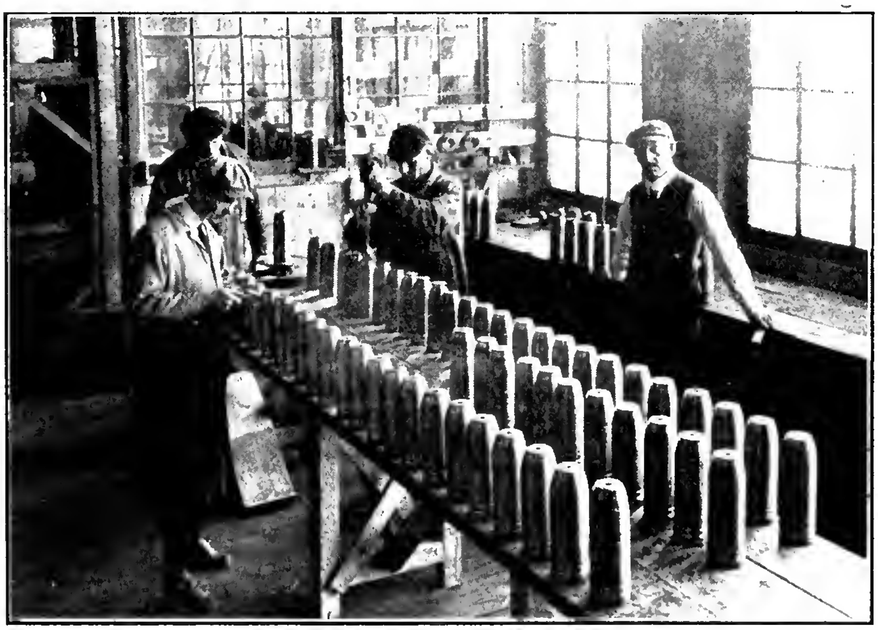


FIG. 15. INSPECTION DEPARTMENT.

FIG. 16. SHELL COMMITTEE OF LYMBURNER'S, MONTREAL
From left to right: Mr. Halley, Mr. Lymburner, Mr. Auger, Mr. Lemieux, Mr. Cotsby, Mr. Lacelx, Mr. Duplessis

rod N, which is raised by means of the foot treadle O. The shell is then lowered to position and the chuck tightened by the lever controlling the toggle device (not shown); the driving collar is then placed over the shell and the lever J is brought forward and the pins M coming in contact with the dogs K cause the teeth on the inner end to grip and turn the socket. When the socket is screwed home the lever J is released, driving collar removed and the shell ejected by means of the foot treadle.

Cleaning and Painting

After the sockets are finish-turned the tube and powder chamber are cleaned by a blast of compressed air and inspected; they are then taken to the painting and drying shelves, shown in Fig. 14.

Fig. 15 shows a view of the inspection room where the shells are finally tested before being crated.

Shell Committee

The Shell Committee, that is largely responsible for the successful production and high test percentage of this plant, is shown in Fig. 16.

USING A 3-PHASE MOTOR AS A SINGLE PHASE CONVERTER.

By Sidney Rose.

A THREE-PHASE current can be obtained from a three-phase induction motor running on a single phase line, but as the motor will not start on single phase current, some means must be provided to bring it up to speed. This can be done by giving the motor pulley a sharp turn; but a still better method is that shown in Fig. 1. A reaction or choke coal is indicated at L, while R is a non-inductive resistance. These may easily be proportioned, so that there is a difference in phase sufficient to start the motor from rest and bring it up to speed.

When the motor is up to speed, the reaction coil and resistance may be cut out by means of a switch, and it will continue to run. The three-phase motor when up to speed will give out a three-phase current of the same frequency as that of the single phase current supplied to its stator when connected, as shown in Fig. 2. This is due to the fact that in the short circuited secondary or rotor there exists a constant rotating field, notwithstanding the fact that the current exciting the primary or stator is single phase, and, therefore produces only a simple alternating field. This is explained by the characteristic property of the short circuited secondary or rotor.

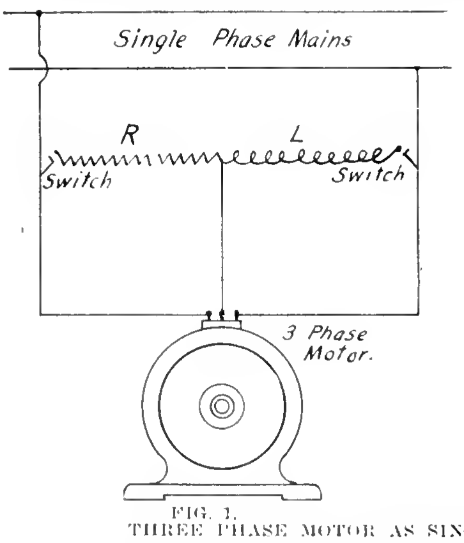


FIG. 1.

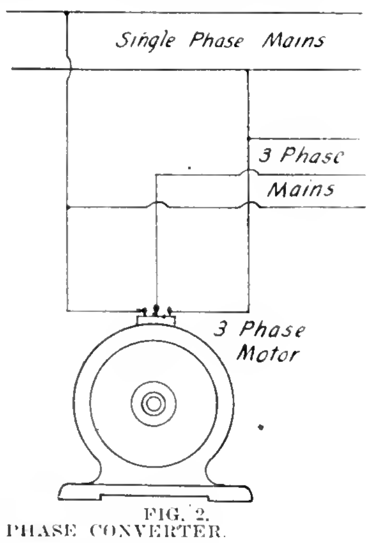


FIG. 2.

THREE PHASE MOTOR AS SINGLE PHASE CONVERTER.

PLATING BY IMPACT

A PROCESS of plating by impact has been in course of development by C. F. Jenkins ,of Washington, D.C., says the Journal of the Franklin Institute. This process can best be understood if it is remembered that, when an electric lamp bulb gives way, a discoloration of the inside of the bulb occurs, and also that when a fuse plug "blows" the mica cover is discolored. This color is black when the fuse is of lead, but it is a reddish color when a piece of copper wire is used.

This would seem to indicate some kind of deposit resulting from the blowing of the fuse, that it is not completely volatilized. Under a magnification of 300 diameters or more, minute particles of the copper wire are discovered adhering to the cover of the fuse plug, and, when a common visiting card is used for a cover instead of the mica, a decided deposit is attained. Repeated charges of such a fuse result in a complete coating of the card. When this surface is burnished with some smooth, hard object, a shiny polished metal surface results.

A fuse used in this manner is, in effect, a gun which throws out a shower of miniature shot so small as to be invisible to the naked eye, and this would operate successfully for covering almost any surface but for the annoyance of the frequent replacements with short pieces of copper wire. This led naturally to the development of a special "gun," into the barrel of which a copper wire is continuously fed. A pair of small rollers actuated by a motor pulls the wire off the supply spool and projects it across the barrel until the end touches the opposite surface. The inner lining of the barrel and the propelling rollers form a short circuit. The wire is immediately melted, and the heat causes it to be thrown out of the barrel against any object held in position for that purpose.

When a plurality of wires or a flat ribbon is used in order to cover a larger area in a given time, it is found desirable to add a propelling force, and this is done by introducing into the barrel behind the wire a small charge of explosive gas. The melting of the wire explodes the charge which projects the miniature metallic particles that are momentarily suspended in the gas against the object to be coated. It has been found that objects in great variety can be coated in this manner, and that any electrically conductive material can be used for the purpose.

ELECTRO-PLATING WITH COBALT

THE results of recent tests in electroplating with cobalt are summarized as follows:—Cobalt plating has a beautiful bluish-white color. The deposit does not tarnish as readily as nickel; it is homogeneous, with a fine, close grain; it is smooth and not brittle, and will easily withstand bending tests. The time required in order to secure a satisfactory deposit is much less with cobalt than with nickel. Metallic cobalt costs more than nickel, but the cost of the salts is of small importance in a comparison of the two as to economy in results.

Because of the greater conductivity of cobalt as compared with nickel, a current of higher density may be used in combination with a solution of less concentration. The time required in the solution with cobalt is one-third that required for nickel, and there is a similar saving of time in the buffing-room.

It seems to be thought necessary in some plants to have long lists of arbitrary rules for the government of employees. As conditions and the character of the workmen vary so much, it is difficult to say how far the matter should be carried. I believe that rules should be as few and simple as is consistent with necessary discipline. The personality of the foreman carries much more weight than rules.

Sheet Metal Elbows: Their Development and Laying Off-II

By J. W. Ross

In order to thoroughly understand the principles involved in the development of cylindrical and other forms, such as are met in sheet metal work, a considerable knowledge of geometry is desirable. Through the medium of these articles, the author places practical examples at the disposal of our readers, and the knowledge to be gained by a close and persistent study of the principles and methods employed will well repay the time spent.

THREE-COURSE ELBOW OF 90 DEGREES

FIG. 10 shows the elevation and cross sectional views of a three-course elbow of 90 degrees. In making these, no matter to what angle of a circle the elbow conforms, it is not necessary to draw out the full elevation view, as has been done here for explanatory purposes. Enough information for constructive purposes can be obtained by calculating the first mitre line and drawing this to the necessary measurements.

To calculate this mitre line, it is the practice to count each end course as one and the intermediate course or courses as two each. The sum of these is divided into the number of degrees of the elbow, the result being the angle of the mitre line. For instance, in the elbow of 90 degrees, as shown in Fig. 10, the courses I and III are each counted as one, the intermediate course as two, the sum being 4. Now, 90 degrees divided by 4 equals 22½ degrees, thus the mitre line BJO is drawn at an angle of 22½ degrees with AO, and the construction ABJK proceeded with.

For the benefit of the student the whole of the elbow will be drawn. As he becomes familiar with elbows he will find it much quicker to work from the calculation of the mitre line just described.

In Fig. 10, measure off AK equal to 1½ inches and KO to 2 inches. With O as centre and radii OK and OA, strike the quadrants KF and AE. Draw EFO at right angles to AKO. As this is a 90-degree elbow and of three courses, then each end course will be counted as one and the centre course as two, which will equal 4. Now divide the quadrant AE into four equal parts. Through these points draw a straight line from O, thus locating the lines OB, OC, and OD, and dividing the angle of 90 degrees into four parts of 22½ degrees each, this being 22½ degrees each for the courses I and III and 45 degrees for the course II.

At right angles to AK draw in the lines AB and KJ, intersecting the mitre line BJ. Similarly draw at right angles to EF the lines DE and GF to the mitre line DG. Connect B to D by a straight line, which will be tangent to the quadrant AE through the point C. Also connect J to G by a straight line. On this construction the outline of the elevation of the elbow is shown as ABCDEFGHJK, Fig. 10. The sections ABJK, BCHJ, CDGH and DEFG are all equal, the first forming No. I. course, and the second and third sections No. II. course, while the last section forms No. III. course, the reason being readily seen why each end course is counted as one, and intermediate courses as two. Obviously if the complete templet is laid out for course I., it will also be a complete templet for course III and a half templet for course II.

Construct the ½ sectional view A4K, using 4^1 as centre and 4^1A as radius. Divide into the desired number of equal spaces. A4K has six equal spaces, and are numbered as 1, 2, 3, 4, 5, 6, 7. These points are projected up to the mitre line BJ, all the lines being drawn at right angles to AK and parallel to AB and KJ. The intersections of these lines on the mitre line are numbered in relation to their divisions on the semi-circle, as

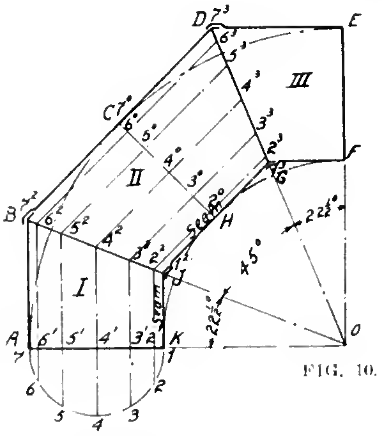


FIG. 10.

shown on the mitre line by the numbers, 7^2, 6^2, 5^2, 4^2, 3^2, 2^2, 1^2. From these points draw in the lines 6^26^3, 5^25^3, etc., parallel to the lines BD and JG.

Measure off the stretchout HCH, Fig. 11, equal to the stretchout of the neutral diameter AK or CH, Fig. 10. This equals 1½×3.14, which is nearly 4¾ inches. HCH, Fig. 11, is measured off 4¾ inches, and divided into 12 equal spaces, which is twice the spaces in the ½ sectional view A4K, Fig. 10. Parallel perpendiculars are drawn to HCH through these located points shown as $1^31^01^2$, $2^32^02^2$, $3^33^03^2$, etc. Set the dividers to the distances 7^07^3, or 7^07^2, Fig. 10, which are equal, and transfer over to 7^07^3 and 7^07^2, Fig. 11. Reset the dividers to the distance 6^06^3 and 6^06^2, Fig. 10, also transfer over to Fig. 11. Similarly transfer over the remainder of the distances on Fig. 10 to their allocated positions on Fig. 11.

An even curve drawn through these located points defines the rivet or mitre line. If suitable, these intersecting points may be used for rivet pitch centres, laps being added accordingly. JGDGJBJ, Fig. 11, shows the complete templet—with rivet holes and laps—for the course No. II., Fig. 10. The templets for the courses I. and II. are shown by drawing a line through HCH, Fig. 11, thus halving the templet, each half being the templet for either course.

It will be seen, as previously pointed out, that all the construction lines for the pattern can be obtained from the first calculated mitre line, as BJ, Fig. 10, thus obtaining the pattern for courses I. and III. and the half pattern for course II. It will be also noticed that in the preceding problems the vertical or longitudinal seams of the courses are placed on the inside throat of the elbow, as FE, ED, Fig. 1; LKJ, Fig. 3; CFE, Fig. 5;

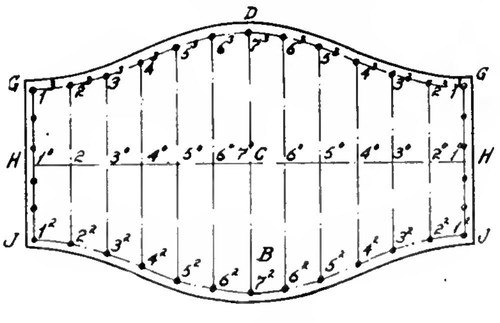


FIG. 11.

and also KJ of course I.; JG, course II.; CF, course III., of Fig. 10. This is the usual practice in the lighter gauges of plate.

In the heavier gauges the seams are generally placed on the centre line of the elevation view, as shown in Fig. 12, also in Fig. 14, the seam of alternate courses being in line, whilst the seam of the adjacent courses are diametrically opposite. The seams being placed at these points, naturally change the contour of the templet usual to the preceding problems.

Of course, if the preceding problems are made in the heavy gauges, it would be better to locate the seams, as will be described in the following problems.

Elbow With Inner and Outer Courses

Fig. 12 shows the elevation and cross sectional view of a cylindrical three-

course 90-degree elbow of heavier plate, with inner and outer courses.

In Fig. 10 and in preceding problems on elbows of light plate, the diameters of the courses were the same throughout in each elbow. This necessitated, for fitting up purposes, that the girth seam of a course should be slightly opened out by machine or by hand methods, so that it would fit over its adjacent course. In the heavier gauges this would be inadvisable, and to overcome this, elbows are made with inner and outer as well as telescopic or clinker courses. Fig. 12 shows an elbow constructed with the in and out courses, showing the thickness of the material for explanatory purposes.

Draw AK, Fig. 12, equal to the outside diameter of the elbow, thus showing the thickness of the plate. The inside diameter is 18 inches, the plate being 1/4-inch thick; the outside diameter will be 18½ inches, and the neutral diameter 18¼ inches.

Measure KO equal to 24 inches. These

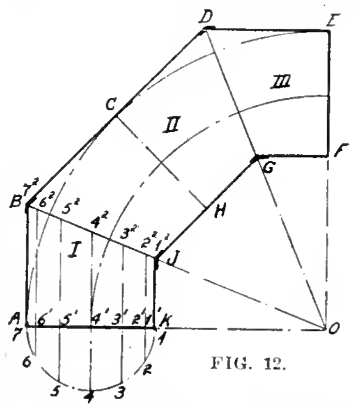


FIG. 12.

measurements may be reduced to scale for paper practice, say, 1 into 1 foot. With O as centre and OA as radius—A being the point located as the inside of the elbow—strike the quadrant AE. Similarly with O as centre and OK as radius, strike the quadrant KF. Thus the inside diameter of these quadrants will represent the inside diameter of the elbow.

As this is a three-course elbow, divide the quadrant AE into four equal parts, as A to B, B to C, C to D, and D to E. Through these points draw straight lines from O, thus locating the mitre lines BO and DO of the elbow. At right angles to AK draw up the lines indicating the thickness of the plate to the mitre line BJ, as AB and KJ. As EFO is at right angles to AKO, draw in the lines DE and GF at right angles to EF.

The intermediate course is an outer one: therefore, draw in the thickness of the plate, as shown, BCD and JHG. Locate the neutral diameter 71, and with 4^1 as centre and 4^17 as radius, strike the neutral half plan view 741. Divide this semi-circle into six equal parts and number as 7, 6, 5, 4, 3, 2, 1. Draw the projection lines 66^16^2, 55^15^2, etc., parallel to the lines AB, JK. The longitudinal seam for this course is located at 4^14^2. The girth seam at BJ.

The neutral diameter of the elbow is 18¼ inches; the stretchout will equal 18¼, multiplied by 3.14, or 3 1-7, which equal 57 5-16 inches along the line SAKS, Fig. 12A. Divide this into twelve equal parts, erect perpendiculars through these points and number as shown, care being observed to locate the vertical seams in their correct positions, 4^14^2, 4^14^2, at the lines SS, SS. Set the dividers to the distances 7^17^2, 6^16^2, 5^15^2, etc., Fig. 12, and transfer over to their relative positions on Fig. 12A. Draw in an even curve through these points for the rivet line, each point also being a rivet centre.

For ¼-inch plate the rivet will be ½-inch diameter, and the holes through the

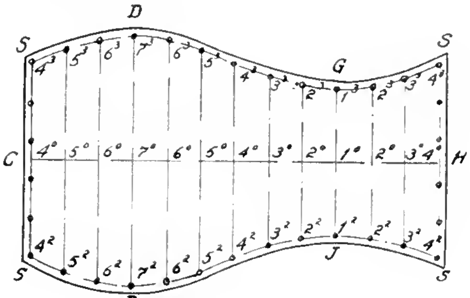


FIG. 13.

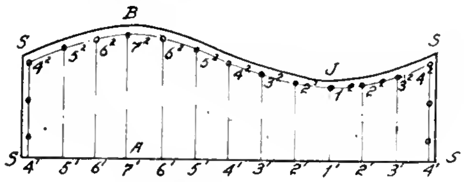


FIG. 12A.

plate 9-16-inch diameter. A suitable lap for this pattern will be twice the diameter of the rivet hole, which equals $2 \times 9\text{-}16 = 1\frac{1}{8}$, this being measured from the rivet line.

Fig. 12A shows the completed templet for courses I. and III. The development for course II. is similar, with the exception that its stretchout is longer than the stretchout of course II.

When one course fits over another, the stretchout is based on whether a tight, easy or slack fit is required, according to the nature of the work. In a previous article it was explained that for good steam-tight work the outer course would be made longer by an amount equal to 6.2 times the thickness of the plate. For an easy fit 6½ times, and for a slack fit 7 times, is used for easy, quick and economical assembling of the parts.

The course I. equals 57 5-16; therefore, the stretchout of course II. will equal $57\ 5\text{-}16 + (7 \times \frac{1}{4}) = 58\ 1\text{-}16$ in. Mark off CH, Fig. 13, equal to 58 1-16 inches. Divide into twelve equal spaces and erect perpendiculars. Number each point accordingly, so that when rolled up the longitudinal seam will be located at the centre of the elevation view similar to course 1, but diametrically opposite. Transfer the distances from course I. to each side of CH, Fig. 13, as shown. Draw in the curve of rivet lap, locate the holes and add on the laps. Divide the rivet lines SS, SS into the same number of equal spaces for the rivet centres.

METALS USED IN MAKING SHELLS

THE metals needed to execute the war orders already placed are estimated at over 10 per cent. of the 1914 copper production of the United States, about 7 per cent. of the spelter output and nearly 20 per cent. of the lead production, says the London Iron and Coal Trades Review.

A British 18-pounder, or 3.3-in. shrapnel, requires 5 lb. 9⅛ oz. of brass containing 66 to 70 per cent. copper, or nearly 3¾ lb. A small copper band around the shell adds 4¾ oz., making the total copper 4.04 lb.

Spelter consumption for a shell of this size is about 1.87 lb.

Lead bullets weighing 7.92 lb. and composed of 7 parts lead to 1 part antimony, constitute the metal load of the projectile.

Estimating the total orders for shrapnel and other shells placed in the United States by Europe at 25,000,000 they would call for a total of 101,000,000 lb. of copper, 46,750,000 lb. of spelter and 173,250,000 lb. of lead. Actually the metal consumption is larger, as a fair proportion of the shells are 4.5-in. howitzer shells using more brass; some 6-in., 7½-in., and probably 9-in. shells are also being made.

Rifle cartridges are made of copper mainly, 1 lb. of it being used in making 24 Lebel cartridges, a type widely used by the French army. Every 125 of these take 1 lb. of spelter and a small amount of nickel.

Steel consumption per shell varies widely in different types. A finished 3.3-in. shell contains 6 lb. 15¼ oz. of steel, the shell weighing 6 lb. 5¾ oz. and the diaphragm 9½ oz. If the shell is made from a steel bar, the weight is about 17 lb., while a forging for the same purpose weighs approximately 14½ lb. and a bottle made by the seamless tube process somewhat less.

Evolution of the Periscope.—The first submarine periscope was invented in 1854 by Marie Davy, but nothing very practical was designed till about forty years later. Mangin's periscope consisted of a ring-shaped mirror which enabled the horizon all around to be viewed. The picture was reflected downwards through the tube, but it was very small and distorted.

Machine Shop Production of 9.2" High Explosive Shells

In view of the fact that the manufacture of high explosive shells of sizes probably up to and including 12 inches diameter is likely to be undertaken at an early date in Canada, the following data relative to the machining operations on the 9.2 size will doubtless prove both interesting and instructive. We are indebted to Alfred Herbert, Ltd., Coventry, England, for the text and illustrations which give a fair idea of the work involved.

TWO alternative designs of 9.2-inch high explosive shells have been issued. The first, Mark IV/L, is a "closed in" shell of conventional type, while the alternative design, Mark II/L, has a screwed-in base plug similar to the larger naval shells. The latter design enables "block filling" to be used, and as this is now becoming practically universal, it would appear that the Mark IV/L shell will not be used very extensively and need not, therefore, be discussed meantime.

The forging for the Mark II/L body is made with the nose end closed, the bore is forged fairly close to size, and the outside has a generous machining allowance to take care of eccentricity in the bore of the forging. Alfred Herbert Co. have given much consideration to the machining processes of this shell, and have in course of manufacture machine tools designed specially to secure its quality and quantity production.

An outline sequence of the operations is shown in the line drawing (Fig. 1), the shaded portions indicating the work done at each handling. Before commencing machining operations, the nose end of the forging should be roughly squared up with a fettling wheel, to present a fairly true surface for starting the drill, in second operation.

Operation 1.—The cutting off is done on an ordinary engine lathe of suitable size, fitted with a bell chuck and a revolving steady in the tailstock for supporting the forging. In cutting off, the position of the tool should be carefully measured from the inside of the forging, so as not to leave an excessive amount of metal for removing from the bottom end of the bore.

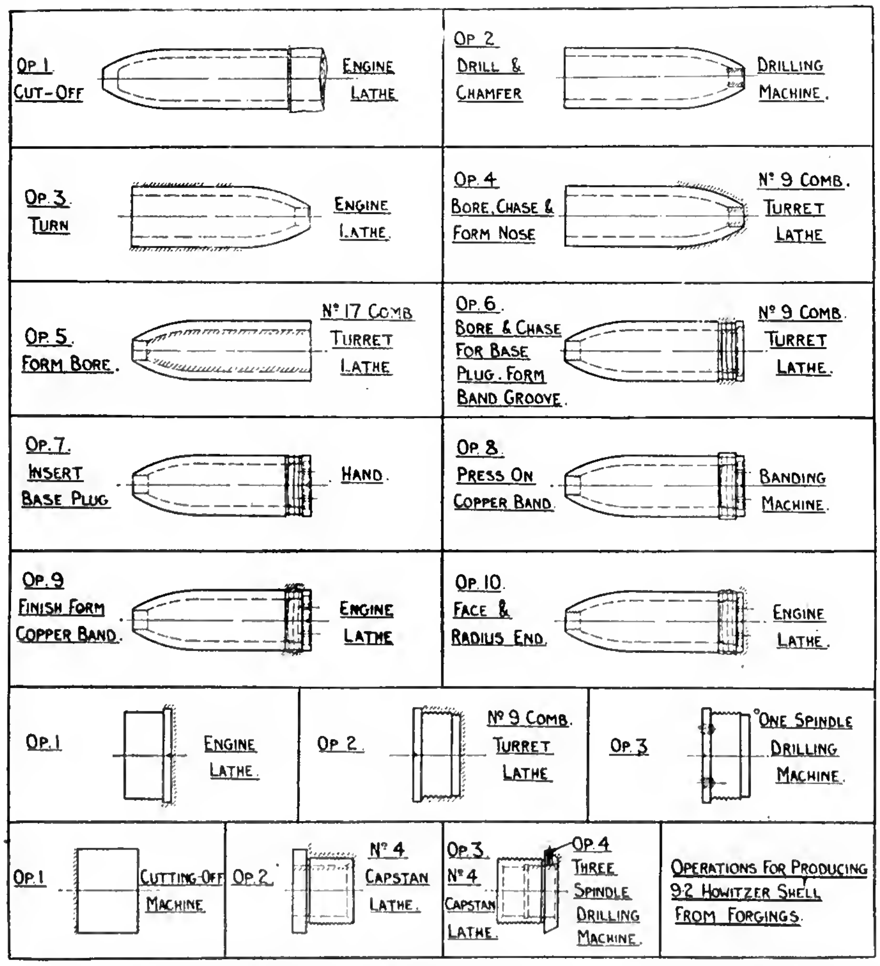


FIG. 1. SHOWING SEQUENCE OF MACHINING OPERATIONS ON 9.2 IN. MARK II/L HIGH EXPLOSIVE HOWITZER SHELL BODIES, BASES AND NOSE BUSHES. THE HATCHED PORTIONS SHOW WHERE MACHINED AT EACH OPERATION.

Operation 2.—The forging is next chucked on a special fixture on a heavy vertical drilling machine, the fixture being of a type which centralizes the forging from the rough bore. A 2¼-in. hole is drilled through the nose and the mouth of the hole coned.

Operation 3.—This consists of rough and finish turning the parallel part of the outside diameter, and is done on an engine lathe. The shell is gripped at the open end by the inside, so as to ensure the rough bore running true, while a running centre fitting in the hole drilled at second operation supports the nose end. Multiple turning tool holders can be used, reducing thereby the turning time considerably.

Operation 4.—Profile turning the nose, finish boring the nose, and threading constitute the fourth operation. This is being done on a simplified "Herbert" No. 9 combination turret lathe, the special equipment of which consists of a bell chuck for gripping by the open end, and a three-point steady. The machine is fitted with a special profile turning attachment, while the screwing is done with a patent chasing saddle. The whole of the machining at this operation is done from the cross slide, therefore the hexagon turret and the quick power traverse are entirely omitted, simplifying the machine considerably.

Operation 5.—This consists of boring the parallel and profiled interior. The machine for this operation is shown in the line drawing (Fig. 2), and is a special turret lathe adapted to the work of shell boring. The headstock has a two-step cone for 6½-in. belt and duplex back gearing. With a two-speed countershaft, 12 spindle speeds are available. The bed length gives sufficient travel for the turret slide, and provides a base for carrying the support for the formers.

The turret slide is of a special form and carries a special turret. The base of the turret forms a circular turntable located in a recess in the slide, and held down by a circular gib. The upper part of the turret consists of two massive bosses with loose caps, which form a long support for the boring bar, in which it can be securely clamped by four nuts. The turret slide carries an indexing bolt arranged to lock the turret in either of two stations 180° apart, and the turret can, in addition, be solidly clamped to the slide by two clamping pads. These are for use with double-ended boring bars not controlled by a former, which

would thus enable the machine to be used for boring Mark IV/L shell if required.

When using former controlled boring bars, the indexing bolt is disengaged, and the turret left free to rotate under the influence of the former slide. The turret slide has an apron of the standard type, and is provided with the usual quick power traverse motion along the bed. There are two automatic and dead stops for the two stations of the turret, which operate when the motion of the turret is towards the headstock. The turret has six changes of reversible feed, by three-step cone, gear change in the apron, and reverse box. Pump and oil supply to the bar for each station of the turret are provided, arrangements being made for accommodating the varying angular positions of the turret when using former controlled bars.

The boring bar is made of steel, and in a bracket at the tail end is carried the tracer roller, which engages with the former. Provision is made for putting on the cut from this end of the boring bar, which thus enables cuts to be started at the nose end of the shell, the turret traversing away from the headstock. This is an advantage, as the chips are more easily carried out of the bore.

A bracket attached to the bed of the machine supports the boring bar rigidly under the cut, and can be easily moved out of the way for taking the shell out of the chuck. The chuck used is of a simple design, and the outward end of the shell is supported in a three-point steady.

Operation 6.—This consists of boring the thread to receive the base plug, counterboring the end, forming the band groove, and the waved ribs. It is done on a combination turret lathe, similar to that used for the fourth operation, except that the profile attachment is not included. The boring, chasing and forming of the band grooves are all done from the square turret, the waving being done from the back of the cross slide by a special slide operated by a former cam, which is attached to the shell itself. The shell is chucked as in the fifth operation.

Operation 7.—This consists of screwing in and fixing the base plug (the machining of which is described later): being a hand operation, it needs no comment.

Operation 8.—The copper band is pressed on by any suitable type of press which may be available.

Operation 9.—The forming of the band is done on engine lathes, the chucking being done by a screwed peg fitted in the nose of the shell, which is locked up by a coned lock nut. The base end may be supported either by a dead centre in the base plug or else by running in a three-point steady on the outside diameter. The latter is probably the better method, as it ensures concentricity between the band and the body of the shell.

Owing to the rather complicated form of the band, a number of tools are required, and these may be carried in a suitable holder, each tool being successively applied to the work, being positioned by suitable stops.

Operation 10.—This consists of facing off the base plug in position, and forming the radius on the end. The operation is performed on an engine lathe,, the method of chucking being the same as in the ninth operation.

The Base Plug

Operation 1.—The forging is held in a three-jaw chuck on an engine lathe, and the 7-in. diameter is turned, faced and centred.

Operation 2.—This is performed on a combination turret lathe, similar to that used on the body in the sixth operation. The threads are rapidly cut with a patent chasing saddle, separate rough and finish chasers being used.

Operation 3.—The two tommy holes are drilled on a single spindle ball bearing drilling machine, the jig used being of simple design.

The Nose Bush

Although it is permissible to form the nose bush solid with the shell body, we consider it better practice, on a shell of this size, to make a separate nose bush, as it enables a stronger boring bar to be used for the fifth operation on the shell body.

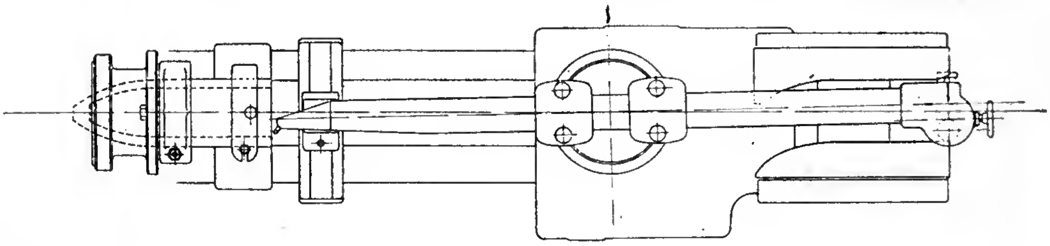
Operation 1.—The blanks are cut off to length on any type of cutting-off machine.

Operation 2.—This is done on a No. 4 capstan lathe, the external thread diameter being turned and chased, and the 1.9-in. hole drilled, bored and coned.

Operation 3.—This is also done on a No. 4 capstan lathe, the bush being held in a special chuck and drawing back by the external thread. The 2-in. thread diameter is finish-bored, recessed and chased, and the outside diameter formed.

Operation 4.—This consists of drilling the hole for the fixing screw, and is done on a three-spindle ball bearing drilling machine, the tools being of a simple design, and calling for no comment.

Sometimes a machine screw breaks off, and then if you don't know just how to remove it you're up against it. Next time this happens go at it in this way: Take a small square chisel and sharpen it to a point. Then drill a small hole in the machine screw you want to take out. Insert the point of the chisel in the hole in the screw and strike the blunt end of the chisel a pretty good blow with a hammer. After that it will be an easy matter, by using a wrench, to turn the screw out.



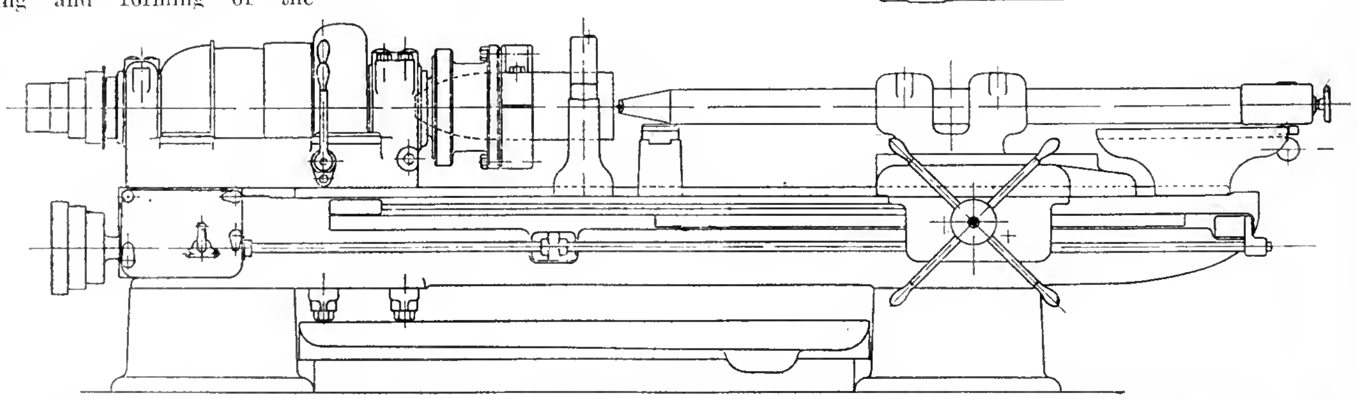


FIG. 2. OUTLINE DRAWING OF SPECIAL LATHE FOR BORING 9.2 IN. HIGH EXPLOSIVE HOWITZER SHELL BODIES.

THREADING DIES AND PIPE-CUTTING TOOLS

By J. E. H.

THE article under the above heading by P. W. Blair in the August issue of The Power House is all right so far as it goes. I wish to differ with him on one point, however. With reference to securing good threads, he writes, "The whole secret lies in the proper care taken of the tools and the lubricant used." The lubricant and care used are certainly important points in connection with threading tools, but the proper design of the die or chasers is much more so. Mr. Blair draws attention to several important matters but does not give the information necessary for their proper appreciation. I have had some experience along this line and will endeavor to place the matter before your readers in greater detail.

Getting Good Results

To get good results in threading at one cut the experience of the National Tube Co. shows that a die should have a suitable number of chasers, the approximate number being determined by the size of the die.

Machine or adjustable hand stocks and dies for $\frac{1}{4}$-inch up to $1\frac{1}{4}$ inches should have at least 4 chasers; $1\frac{1}{2}$ in to 4 in. should have approximately 6 chasers; $4\frac{1}{2}$ in. to 8 in., say 8 chasers; 9 in. to 12 in., say 12 chasers; 12 in. to 16 in., say 14 chasers, and 17 in. to 20 in., say 16 chasers.

Some readers of this journal may not agree with the above table, but in practice the results obtained have been the best possible after numerous tests. The experience of pipe manufacturers and others who do their own threading by machinery, shows that steel and iron pipe can be threaded equally rapidly and efficiently when the proper form of die is used, and the same may be said for properly designed dies used in ordinary hand stocks.

In order to obtain good results in threading any metal, the die must be made to cut and the pushing effect must be avoided. A chaser which pushes the material off, instead of cutting it freely, causes the threads to break out of the die. A die should be made with the proper consideration for the following points: Lip, chip space, clearance, lead or throat, and sufficient number of chasers.

Lip

This is also known as hook or rake, and is the inclination of the cutting edge of the chaser to the surface of the pipe, as shown diagrammatically in Figs. 1 and 2. This effect may be secured by milling the cutting face of the chaser, or by inclining the latter. The lip angle should be from 15 to 25 degrees, depending upon the style and condition of the chasers and chaser-holders.

Fig. 1 shows a chaser properly lipped for cutting ordinary steel pipe, the unbroken line showing how the lip should be ground. Care should be taken when sharpening the face of the chaser to maintain a good cutting angle—shown by the dotted line. Grinding back the face of the chaser does no harm if properly done.

Fig. 2 shows a die lipped for cutting open-hearth steel pipe, which requires a long, easy lip on account of the tough character of the material; the angle should be about 25°.

Fig. 3 shows a form of commercial die which is unsuitable for properly threading steel or wrought iron pipe. The dotted line shows how the die is usually made, in spite of the fact that this plainly makes a duller cutting edge than when ground as shown by the full lines.

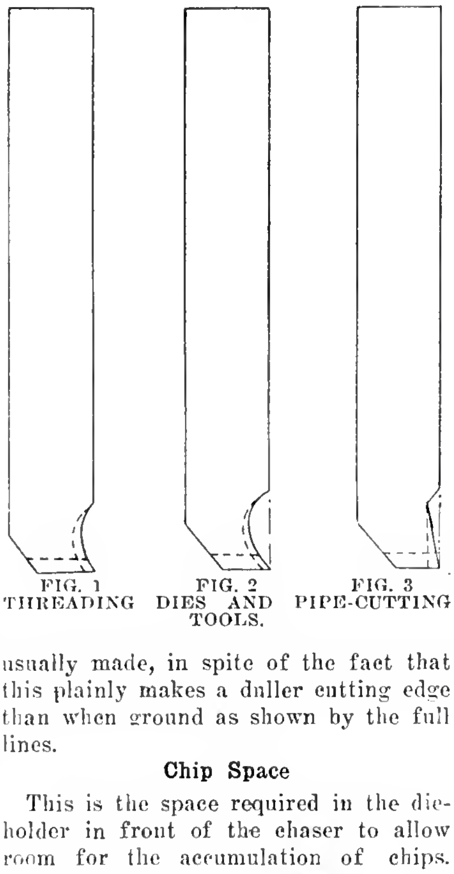


FIG. 1 FIG. 2 FIG. 3
THREADING DIES AND PIPE-CUTTING TOOLS.

Chip Space

This is the space required in the die-holder in front of the chaser to allow room for the accumulation of chips. "The importance of this feature cannot be too strongly emphasized," says the National Bulletin, "for if insufficient space be allowed, the chips will rapidly pack in front of the chaser and will soon begin to tear the thread." If the chip space is too small the die or chaser should project considerably beyond the ring.

Chip space is a particularly important consideration in dies used for cutting open-hearth steel pipe, as ample space is needed to care for the long, tough chips produced in threading this material. The lack of this feature in many commercial dies causes much of the difficulty often experienced in threading this class of pipe.

Clearance

This consists of the angle between the threads of the chasers and the threads of the pipe. When the chaser has been in use for some time, the sides of the threads become polished, brighter at the cutting edge, and gradually shading almost to their original color at the back. The chaser of a die which shows this condition will work freely, cut clean, will not tear the threads and will be durable. When the chasers of a die show a polish from the cutting edge to the back, there is a lack of clearance causing the cutting edge to work hard, heat, and make a rough, torn thread.

Lead or Throat

This is the angle which is machined or ground on the front of each chaser to enable the die to start on the pipe. The proper amount of lead is about three threads. As the heaviest cutting is done by the lead it should have a slightly greater clearance angle than the rest of the threads on the chaser. It should be noted that if the lead on only one chaser requires grinding to sharpen it, the whole set must be gone over in order to make the die cut evenly.

Lubricant

The best die made will not produce good results with poor oil. A lubricant particularly adapted to power machines where there is a steady flow of lubricant and which is also inexpensive, is composer of 30 per cent. cotton seed oil and 70 per cent. light neutral oil.

For hand tools, No. 1 lard oil may be used with success, as cottonseed oils have a tendency to gum up if the dies are not in constant service.

A die made by experienced tool makers with due regard to the points mentioned will thread wrought iron or steel pipe with good results. Much of the pipe on the market is steel, and it is naturally somewhat more difficult to thread with the old form of die.

In a paper by T. N. Thomson, read before the American Society of Heating and Ventilating Engineers, the author said: "The power required to thread mild steel pipe with a properly made die is not much more than that required to thread wrought iron with the same die, and much less than the power required to thread wrought iron pipe with a common die."

Executive ability can doubtless be cultivated by study and experience, but the man who has no natural talent in that direction, will never be a success as a foreman, superintendent or manager. Tact, or a knowledge of human nature, which enables one to treat each workman so as to bring out the best that is in him, is a very essential requirement.

Papers Read at the Recent Foundrymen's Convention

Selected from the more important subjects presented for discussion before the Annual Convention of the American Foundrymen's Association and the American Institute of Metals at Atlantic City, N.J., during September, 1915. The papers cover a wide field of foundry and allied activity, the nature of the results and the completeness of the reports making them of particular interest to all who desire to keep in touch with metallurgical progress.

MANUFACTURE AND USES OF WROUGHT MANGANESE BRONZE

Jesse L. Jones*

MANGANESE bronze when introduced into the United States from England about 1893, found its first important application in the manufacture of propeller blades because of its strength and toughness and the fact that it is practically incorrodible in sea water. The low melting point of the cast manganese bronze and the ease with which it can be cast into the most intricate forms lead to its adoption for many automobile parts and numerous other applications where service conditions are extremely severe.

The rolling and forging grades of manganese bronze had at first very few applications. The greater cheapness of the cast manganese bronze, its remarkable uniformity and excellence, and the fact that there was so little difference between it and the hot rolled grades as to physical characteristics, discouraged the use of wrought manganese bronze in many quarters.

As a rule, however, designing engineers consider forgings more reliable than castings, and they ascertained also that wrought manganese bronze has much greater strength and ductility than yellow brass, Muntz metal, Tobin bronze, etc. Hence forged manganese bronze began to be used in various water supply and irrigation projects. Forgings over three and three-quarters inches in diameter, more than twenty feet long and weighing over 900 lbs. have been successfully made. There is no record that any of these forgings have proved unsatisfactory or have failed in service.

Other applications are for piston rods, shafting, axles, etc., for machinery to be used in mines where there is corrosive water, or on shipboard for turret parts in connection with gun mounts, ordnance attachments, etc., where the metal must resist corrosion by sea water. A very soft, tough grade is used for sheet metal which has found application in the hulls of racing yachts, staybolts for locomotives and other bolts that must resist shock or the effect of repeated stresses. Extrufled manganese bronze blades have found some application in steam turbine construction where the erosive action of high-pressure steam is very severe. A large amount of wrought manganese bronze is used by powder and explosive manufacturers in situations where strength and non-corrosiveness is demanded, or where the use of steel would be dangerous by reason of its giving off sparks when struck.

Composition

Wrought manganese bronze differs chiefly from the casting grade in being free from aluminum. The addition of aluminum enables the alloy to be cast satisfactorily in sand molds. The following specifications as to composition may be considered as representative of the manganese bronze alloys most generally used:

Grade	No. 1A (for bars)	No. 1B (for sheets	No. 2 (for sand castings)
Aluminum ...	nil	nil	.15
Copper	57.35	58.15	56.00
Iron	1.40	.75	1.40
Lead	.03	.03	.03
Manganese ...	.02	.02	.12
Tin	1.20	.45	1.05
Zinc	40.00	40.60	41.25

Pure Metals Necessary

In order to secure ductility as well as high tensile strength, extreme purity of the materials used is absolutely essential.

The grade of copper used in England is known as "Best Selected." It is of good quality, except that it contains antimony and arsenic which harden and lower the ductility of any alloy in which the copper is used. In the United States, opinion as to which is the best grade of copper is somewhat divided. Non-arsenical Lake copper is usually preferred for particular work, because of its uniformity in quality, although the best grades of electrolytic copper are of equal analytical purity. The impurities usually present are as follows:

Copper Analysis.

	"Best selected"	"Lake"
Antimony	.019	nil
Arsenic	.023	nil
Copper	99.895	99.881
Copper suboxide	trace	.112
Iron	.056	.001
Lead	nil	trace
Silver	.007	.003
Sulphur	nil	trace

In the manufacture of manganese bronze the selection of a pure grade of zinc is perhaps more important than any other one consideration. Freedom from lead is essential, as lead oxidizes readily and makes drossy brittle metal. Absolutely pure zinc would be an ideal material, and while it can be and has been produced commercially, its high cost has militated against its use. Dr. Jos. W. Richards made several tons of electrolytic zinc a few years ago in Philadelphia, but no market could be found for it.

A very pure zinc is produced in Eastern Pennsylvania from a willemite or silicate of zinc ore. The concentrate used contains garnet, rhadocrosite, red oxide of zinc and Franklinite. The ore will average 49.26 per cent. zinc and 3.50 per cent. manganese. The slab zinc is marketed under various names, and it produces a manganeze bronze of remarkable strength and ductility.

A zinc of almost equal purity is produced by the double distillation of galvanizer's dross, the slabs being skimmed just before setting so as to remove any impurities that rise to the surface. While there is little difference in the analysis of zinc made from willemite and that made from dross the former has the greater toughness and strength. Perhaps this is due to the manganese in the ore. At any rate, if samples of the two grades of zinc of almost identical analysis are cast into slush molds, the one casting is liable to crack and the other will not. For this reason, makers of intricate slush zinc castings are compelled to use the willemite zinc. A number of the makers of high-grade zinc use the slush mold as a means of testing their product, and it will be found a very satisfactory way of testing zinc to be used for making manganese bronze.

The ordinary grades of spelter known as "Prime Western" are high in lead and for this reason should never be used. Scrap zinc reclaimed from sheet, etc., is also poor material. It may be high in lead and tin because of having been soldered, or it may contain much cadmium, which element has a hardening effect on manganese bronze. The grade of spelter used in England in conjunction with "Best Selected" copper is a French spelter known as Font-d'Art.

Melting

Crucibles are generally used for making forging manganese bronze, the heats being 325 lbs. each and requiring a No. 125 crucible. More recently there has been a tendency to use a No. 300 crucible as the smaller crucibles limit the output. Another reason for using the larger crucibles is that when a number of furnaces are attached to the same stack there are variations in the draft and it is seldom that any two crucibles can be brought out at the same temperature.

The copper is first melted, then superheated, keeping it carefully covered with

*Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

charcoal all the while. Next the iron and manganese additions are made from a small crucible in which they have been separately melted. Finally the zinc is added a little at a time with constant stirring and the alloy poured into ingots for melting. The remelting is considered necessary to secure a more uniform distribution of the iron and manganese. If the initial temperature of the copper is not high enough, or if the zinc is added too rapidly, the iron addition is thrown out of solution to a greater or less extent and is found disseminated through the ingots in the form of small shot which are practically high carbon tool steel. These shot will knock the edge from a machining tool in a few minutes and cause cracks in a forging when it is stressed. The composition of these shot is indicated below:

Aluminum	nil
Carbon, combined	4.34
Carbon, graphitic	.66
Copper	3.82
Iron	89.44
Manganese	trace
Phosphorus	.010
Silicon	trace
Sulphur	.020
Tin	.110
Zinc	.870

It is not difficult to obtain a uniform alloy, however, if due regard is had to the temperature of the copper. The copper must not only be hot, but very hot, as it is much easier to make bad metal by underheating than by overheating.

Where the ingot metal is remelted for pouring into slabs or billets, reverberatory furnaces can be used if intelligently handled.

The only entirely satisfactory method of melting manganese bronze is in the open-flame, oil-fired type of furnace. The melting loss is low, the additions can be thoroughly alloyed and the metal poled and worked so that remelting is entirely unnecessary and the metal can be poured into billets at once without the usual double melting loss. Large heats up to 20,000 lbs. can be made and the resulting economy is considerable.

Pouring

The removal of dross from manganese bronze that is poured into slabs may be accomplished by skimming the slabs just before the metal solidifies.

In making large ingots, a crucible with a hole in the bottom, may be set on top of the ingot mold, and by keeping the crucible partly filled with molten metal, the entrance of dross is prevented. When the metal is poured, there should be as little drop as possible, for a long drop results in forming much dross. Hence, ingots should be short and thick if possible. Bottom pouring would be a good thing, only it would give cold metal at the top of the ingot and result in the formation of long pipes. With care a discard of only 2 per cent. from the top of the ingots is possible. As the surface of the ingots is liable to be rough and full of cold-shuts, the ingots must be overhauled or rough turned before forging or rolling in oder to avoid blister or slivers in the finished product.

The pouring temperature of the bronze must not be too high or it will cut the molds and become contaminated in this way with cast iron.

In time the ingot molds become coated with a layer of metallic zinc mixed with zinc oxide which has sublimed from the red hot ingots and condensed on the face of the molds. Unless this deposit is removed by scraping the molds or heating them to a red heat in an annealing furnace, the quality of the ingot metal soon deteriorates. The zinc seems to diffuse through the ingot in a remarkable manner, possibly being deposited along the margins of the crystal grains in the form of metallic zinc and makes the bronze less ductile. At times, too, this layer of zinc on the mold will produce such a volume of zinc vapor when the bronze is poured that the ingot is full of blowholes.

Forging

Manganese bronze can be readily forged, drop-forged, rolled or extruded at a red heat. The physical characteristics will depend on the finishing temperature. The material hardens rapidly when worked cold, and machinery designed for the cold rolling and drawing of Tobin bronze, Muntz metal and yellow brass is not usually powerful enough to handle manganese bronze properly. This may result in the exterior of an article being overstrained while the interior is soft and comparatively unwrought. Excessive cold work on manganese bronze makes it glass hard and it may even become full of hair cracks and incipient fissures invisible to the eye, but capable of being shown by stressing. An infallible test for excessive cold work on material otherwise of good quality is the appearance of the fracture of a test piece. If cup-shaped or lipped like the fracture of a soft steel specimen, assurance may be had that the manganese bronze has been given the proper heat and forging treatment. If, however, the fracture is conchoidal and irregular, excessive cold work without proper annealing is indicated.

Other Grades of Forging Manganese Bronze

As the number of firms making manganese bronze has increased, there has been more or less competition for the business available and the quality of the metals used in the bronze has not always been as high as it should be. This has resulted in lessened ductility. Another cause for this fault is the desire for a higher tensile strength on the part of some designing engineers. To meet this demand, manufacturers have resorted to various plans which gave bronze of a higher tensile strength and elastic limit, but always with less ductility.

One manufacturer uses the casting grade of bronze, melts it in an open flame furnace and poles the metal until a part of the zinc is removed and much of the dross and dirt. This gives an extremely clean and tough metal for sand castings, but it is not especially suitable for forging, as there is always some entangled alumina in the bronze that cannot be removed and which may cause defects. Further, this grade of bronze hardens too rapidly when hammered and hair-cracks are nearly always present in the finished forging unless unusual care is observed.

Another maker uses one-half casting mixture and one-half forging mixture with the addition of a little extra manganese. A tensile strength of over 90,000 lbs. is thus secured, but the objections noted above hold good also for this mixture.

Other manufacturers have increased the aluminum by several per cent. or the manganese or both, and have made additions of vanadium, titanium, etc., obtaining in this way a tensile strength as high as 125,000 lbs. per square inch, but with an elongation that is seldom more than 20 per cent.

Any radical departure from the formulas given in the first part of this paper or the use of any but the purest materials can only result in inferior manganese bronze. Safety is not found in extremely high tensile strength, but in great ductility and in avoiding excessive cold working. A tensile strength of say 70,000 lbs. should not be exceeded. Great ductility allows more leeway in forging, but cold work is always objectionable, as it may result in hidden ruptures or later on in the so-called "season cracking." No manganese bronze, however ductile, in fact no wrought non-ferrous alloy whatever, can be said to be able to safely withstand excessive cold work that strains it above the elastic limit.

The future should see a more extended use of wrought manganese bronze. Its physical characteristics warrant a wider field for it. If those who manufacture it make quality the first consideration and if those who use it specify it intelligently, it will find a wide application.

Perhaps not always, but quite often, the skill of a machine operator can be measured by the condition of his machine.

The purpose of labor-saving machinery is generally to take the place of muscular effort; it is presumed the operator will always do the brain work.

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Machine, Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

200 H.P. HIGH COMPRESSION OIL ENGINE

IN large sizes, the Nordberg Manufacturing Co., of Milwaukee, Wisconsin, builds Diesel engines of the "Carels Freres" type but for moderate sized units, namely, 50 to 200 horse-power. They build a high compression oil engine designed to meet the demand for an engine as simple as a slide valve steam engine.

The accompanying photographs illustrate the 200 horse-power 270 r.p.m. size, "Nordberg" high compression oil engine, also details of starting gear and fuel pumps. These engines resemble Diesel engines in so far as concerns the method of ignition by the heat of the highly compressed air. The compression pressures are about 450 lbs. A three-stage high pressure air compressor to register 1,000 lbs. is not used for injecting and atomizing the fuel. The fuel is injected mechanically by a small pump and discharges through a new type of atomizing head which successfully subdivides and atomizes the oil. The success of the engine is, we understand, due largely to the effective working of this atomizing head. (See Fig. 4.) The elimination of the high pressure compressor with its intercoolers simplifies the installation in small plants for which these engines are designed.

The engine is of the two-cycle design, and all valves, cams, springs and valve gear have been eliminated, contributing further to the item of simplicity and ease of attendance and inspection. The head is a simple symmetrical casting, and is not subject to cracks due to unequal expansion strains. There are no valves in the head. The only valve on the engine is a piston valve for scavenging air located above and between the cylinders in the 200 horse-power illustrated. One valve controls the scavenging air for the two cylinders. Air is

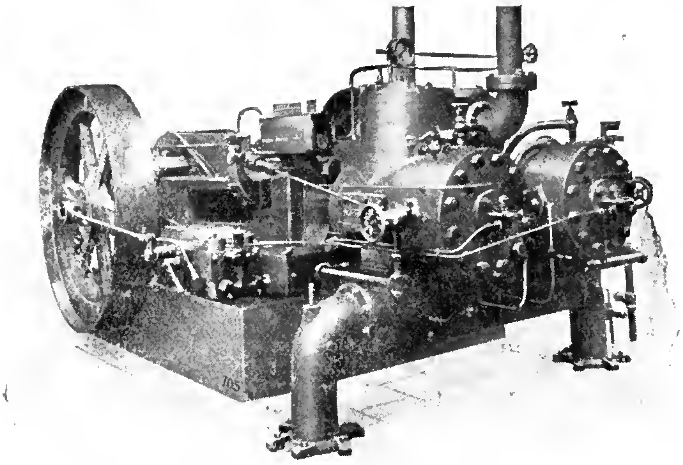


FIG. 1. "NORDBERG" 200 H.P. HIGH COMPRESSION OIL ENGINE FROM THE FUEL PUMP SIDE.

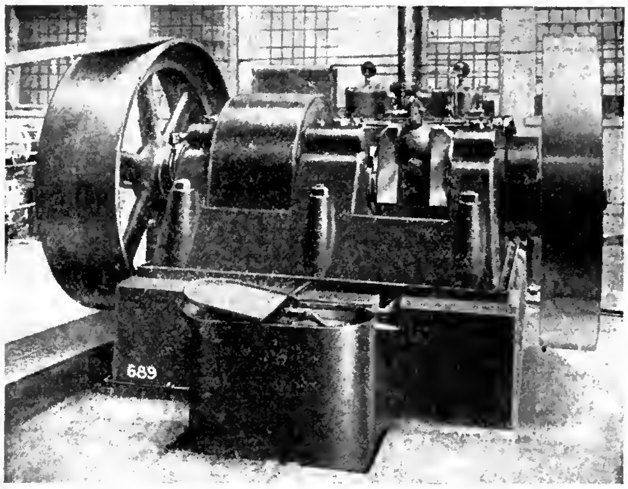


FIG. 2. "NORDBERG" 200 H.P. HIGH COMPRESSION OIL ENGINE WITH ONE CRANK CASE GUARD REMOVED.

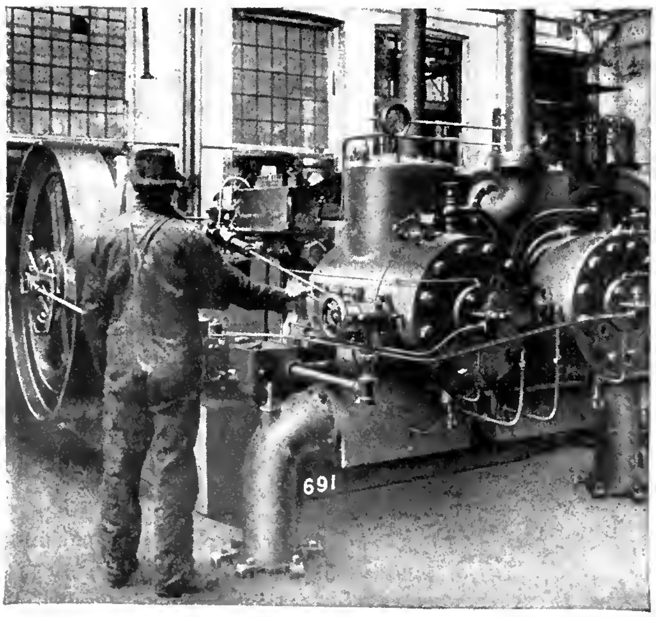


FIG. 3. STARTING "NORDBERG" 200 H.P. OIL ENGINE.

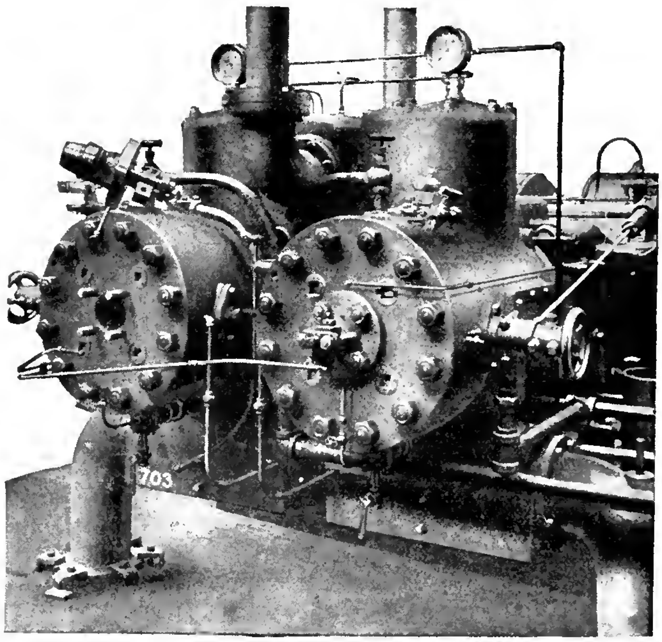


FIG. 4. CYLINDERS OF TWIN 200 H.P. OIL ENGINE.

compressed on the crank side of the piston and by-passed to the head end shortly after the uncovering of the exhaust valves. This forces the burnt gases out of the cylinder and fills it with fresh air. Compression and combustion then occur as in any two-cycle engine. The air intake is through the vertical pipes above the engine, and exhaust through the pipes going through the floor.

In the 200 h.p. twin engine, a special automatic starting arrangement has been designed simplifying the operation so that engine may be brought to speed in less than a minute.

Fig. 3 shows the operator starting the engine by rocking an air valve which turns the engine over and at the same time throws in two auxiliary air cams which thereafter admit air at the proper points in the stroke to each of the two cylinders. The starting air is furnished by a steel tank previously charged to 250 lbs. from a small auxiliary compressor. When the engine has come to speed, one of the cams is thrown out by the corresponding finger shown near the top of Fig. 5, and at the same time the corresponding fuel pump is thrown into action by one of two levers on the same side of the engine, which may also be seen in Fig. 5. As soon as this cylinder fires, the air cam for the other cylinder is thrown out and the second fuel pump thrown into gear. The engine is then under control of the governor.

Fig. 5 shows the details of the fuel pumps which run in a bath of lubricating oil, the fuel levers and fuel governing mechanism. The oil is drawn from the storage tank to a small strainer box located to the right and behind the pumps from which it flows to the main fuel pumps. A small heating coil, through which heated jacket water circulates, is contained in the main oil compartment of the strainer box to insure free flow of very viscous oils. The pumps are operated by cams driven by an eccentric and deliver a quantity of oil in excess of that required for maximum load, the governor acting to by-pass more or less of the fuel depending on the load obtaining.

The by-passed oil is discharged through the sight glass and gives the operator a quick check on the working of each of the pumps. The governor is of the well-known fly wheel design, and gives a regulation of 2 per cent. from no load to full load. From the fuel pumps the oil is discharged through small pipes to the atomizer heads bolted to the main cylinder heads, as shown in Fig. 3, and also in Fig. 4, where one atomizer head has been removed and placed on top of a cylinder. This device breaks up the fuel in fine particles and distributes it evenly over the entire section of the cylinder in the same manner as does the fuel valve using highly compressed air in Diesel engines.

The lubricating system of the engines is entirely automatic, oil being fed from a central pump driven from the scavenging valve eccentric, shown in Fig. 5. Cylinder oil is pumped to the scavenging air valve and to the main cylinders. Bearing oil is pumped to all main bearings, to the crosshead pins through trombone oilers and to all auxiliary bearings. The cranks are enclosed by polished iron guards, as shown in Fig. 2, and the oil accumulates in the crank case from various parts of the engine, and is drained to a filter and returned to the lubricator. Fig. 2 also shows the frame, bearing and crank construction in these twin engines.

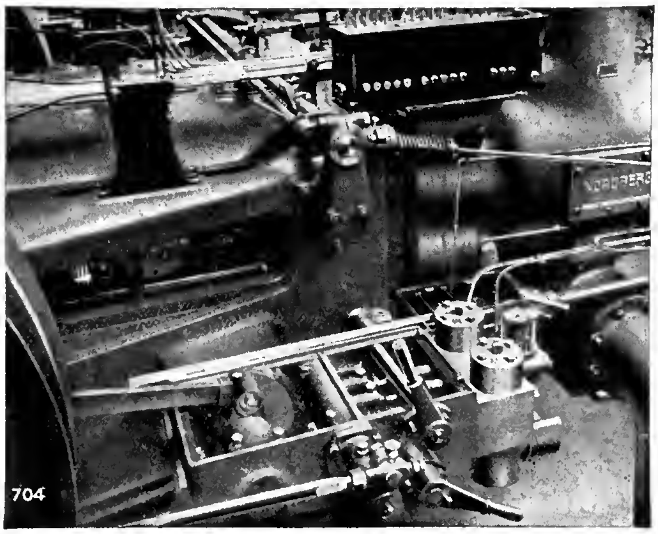


FIG. 5. VIEW OF FUEL INJECTION PUMPS, STRAINER TANK AND AIR STARTING GEAR OF "NORDBERG" OIL ENGINE.

The photographs of the engine shown herewith were taken in the Test Department of the Nordberg Manufacturing Co., where permanent concrete testing blocks have been installed for each of the three sizes of high compression oil engine built. Before shipment these engines are given routine tests for economy and mechanical troubles.

"LEA" V-NOTCH METER INTEGRATOR IMPROVEMENT

THE Yarnall-Waring Co. are placing on the market a new and more heavily designed integrator, for use on their well-known "Lea" V-notch recording liquid meter. Figure 1 shows the type which has been used for a number of years, and Figure 2 illustrates the new type.

In the new type, the aluminum dial which drives the integrator counter is in turn driven by means of a pendulum clock movement, built especially by the Seth Thomas Co. for this service. It has a double heavy spring pendulum movement, which is so constructed that vapor and dust do not seriously affect its accuracy.

It has been found advisable in practice to use a clock mechanism for the operation of the integrator separate from the clock mechanism which operates the chart recording mechanism, for the reason that if either clock should be deranged in service the user still has the other clock to depend upon. In addition to this advantage, one clock can be used as a check against the other, and more dependably accurate results be obtained.

The original "Lea" V-notch instruments were built with hand screws for making adjustments. It has been found, however, that in a few instances in power plant service vibration sometimes caused these thumb screws to loosen slightly. Hence, in the new model instrument heavy screws with slotted heads are employed for making adjustments. A screw driver only is needed for making such adjustments, and these when carefully made are found to be more secure than with the old type thumb screw.

In the new type instrument, the pen arm adjustment has been simplified, also the yoke supporting counter dial on the integrator. The case is so designed that the instrument cannot be affected in any

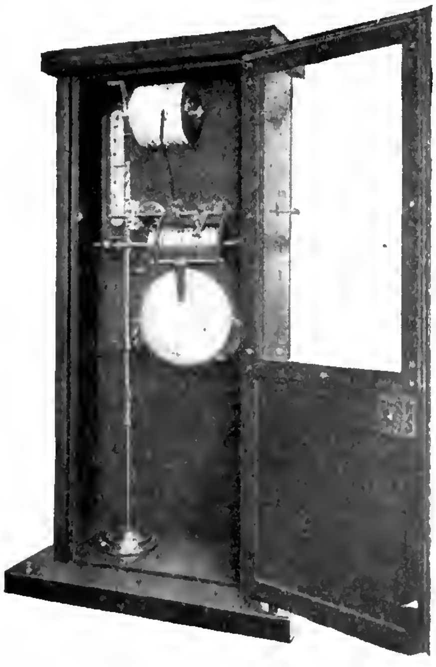


FIG. 1. ORIGINAL "LEA" V. NOTCH INTEGRATOR.

way by steam or vapor getting into the instrument case, nor even by serious vibration. The door of the case is equipped with a tongue entering a felt-lined groove and a three-way locking device

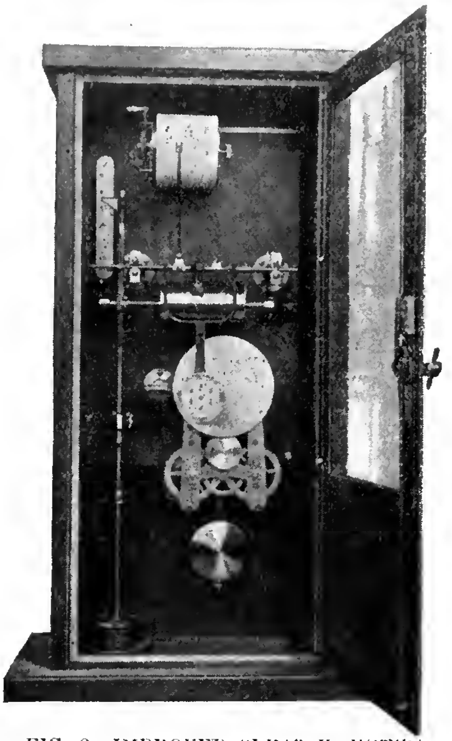
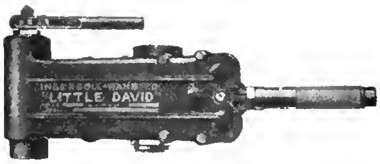


FIG. 2. IMPROVED "LEA" V. NOTCH INTEGRATOR.

jams the door against the felt, making practically an air-tight joint. This is valuable, especially for an instrument which is sometimes set in damp or rusty boiler plants.

NEW PORTABLE "CLOSE QUARTER" DRILL

OF timely interest to those having portable drilling to do, whether in machine shop, boiler shop, foundry, in the field, on bridge construction, or general structural steel work, is a new pneumatic drill for close quarter drilling, reaming, tapping, etc. This tool shown in the accompanying illustration is a recent addition to the "Little David" line of pneumatic tools, manufactured by the Ingersoll-Rand Co., 11 Broadway, New York. It is particularly adapted for working in cramped or confined positions, where the regular type of four piston reciprocating pneumatic drill cannot be used, the distance from the end



CLOSE QUARTER PORTABLE DRILL.

of the casing to the centre of the spindle being only 1 5/16 inches.

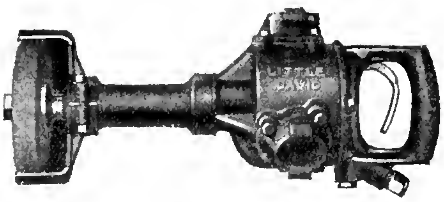
The motor is of a novel three-cylinder design and operates in a bath of oil. The valve is of the rotary type, and is gear driven from the pinion of a three-way crank shaft. This crank shaft is operated by the three ratchet levers which directly connect the pistons to the drill spindle.

An important feature of the machine is that there is practically no strain on the crank shaft, as the power is transmitted direct from the pistons through the levers to the ratchet spindle. The spindle has a triple ratchet, and a noteworthy feature is that one of the ratchets is engaged on the spindle at all times. This construction is claimed by the manufacturers to develop more power and give a more constant pull on the spindle. The casing is divided in such a way that the loosening of a few cap screws allows easy access to all moving parts.

The drill is fitted with a No. 4 "Morse" taper socket; is rotated for drilling up to 3 ins. and reaming and tapping to 2 ins., and operates at a speed of 150 r.p.m.

PORTABLE PNEUMATIC GRINDER

A NEW portable pneumatic grinding machine has recently been introduced by the Ingersoll-Rand Co., New York. The "Little David" grinder, as this tool has been named, has many novel features, and has been designed with special reference to simplicity and accessibility in all its parts. The motor is of the three-cylinder type. The connecting rods are of one-piece construction, fitted to the crank shaft on roller bearings. The crank shaft and spindle are combined



PORTABLE PNEUMATIC GRINDER.

into a solid piece drop forging, which runs on a triple ball bearing, one bearing being used in the front end of the main body of the casing and two bearing on the end of the spindle. All parts are enclosed in an absolutely dust-proof case and operate in a bath of oil.

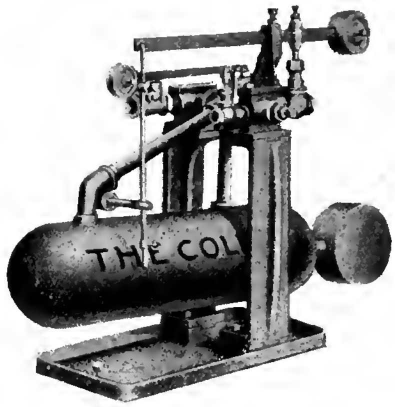
To lessen the complication of delicate parts, the valve construction of the rotating type is made a part of the crank shaft, and works in a renewable bronze bushing. No gears or pinions are used. The connections between the piston and connecting rods are of the same general design as those used in the maker's line of pneumatic drills.

The entire operating mechanism is readily accessible, the loosening of six cap screws removing the handle and exposing the entire interior for examination. The cylinders are renewable without renewing the main body of the casing, and are interchangeable. As may be seen from the illustration, the cylinders are provided with lugs, which take care of the wear on the exposed corners.

This grinder is rated to operate up to an 8 ins. diameter emery wheel at a speed of 3,400 r.p.m., and is specially designed for grinding, buffing, polishing or cleaning castings.

THE "COLE" LIFTING TRAP

THE George W. Cole Co., Toronto, Ont., has recently placed on the market a lifting trap designed to raise condensation from a low pressure heating system to a return trap or open



THE "COLE" LIFTING TRAP.

tank. This trap is also designed to remove condensation from steam systems which operate on very low pressures down to atmospheric or even below.

The accompanying illustration gives a general idea of the construction of the apparatus which is entirely different from the ordinary lifting or return trap in that it is turned upside down. By a special arrangement of levers and fulcrums, a full displacement in the receiving chamber is assured, there being a free escape of the air which usually collects in heating systems and is often a source of considerable trouble.

The trap is provided with self-adjusting packing glands which are readily accessible. It is specially suitable for a modulating type of heating system where the steam enters the top of the radiator and discharges through a swing check or similar type of valve.

If you have any old files around your shop that have apparently seen their best days try this: First clean them well with a fine wire brush and then give them a bath in diluted sulphuric acid. You will find that most of them will be almost as good as new after this treatment.

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THE COMMERCIAL ASPECT OF MUNITIONS' PRODUCTION

RECENT events connected with the conduct of the war would seem to indicate the probability of an immediate change in the methods whereby the British Government may avail itself of the efforts of Canadian manufacturers.

Early in the war certain English textile mills were not inclined to devote all their efforts to war contracts, because of the interruption to their ordinary business. Whether such action was due to indifference or because regular business was more remunerative, does not really matter, but what really does matter is this: Lord Kitchener told these particular firms that their mills would be run on war contracts, if not by themselves, then by the Government. There was no question of a quid pro quo in the form of higher prices or something equivalent. These mills simply had to run on Government work, and they did run.

Since then numerous incidents have occurred which show that many people have not only failed to realize the absolute seriousness of the present struggle, but by their attitude and actions, betray a self interest and indifference, which, if exhibited a few thousand miles nearer the scene of hostilities, would be terminated rather promptly, if not abruptly.

For some considerable time Munitions Tribunals or Courts have been in existence in Britain, their principal sphere of activity being the trial and punishment of employees who are guilty of "slacking" or otherwise retarding the efforts of the nation. These Tribunals have been constituted for dealing with the labor end of the business, and their counterpart for dealing with the employers is found in the action of the Government, whereby factories are taken under control on stated terms, and the utmost possible use made of the plant and equipment. We use the word "possible" because until "slackers" are eliminated, a maximum output will not be obtained.

Owing to stress of circumstances no doubt, the proportion of union labor engaged in munitions manufacture is very much less in this country than in England, consequently, while attempts at slacking may have taken place in some isolated cases, their effect has not been sufficiently noticeable to demand attention.

The resolutions passed recently by certain trades unions affirming their loyalty and disavowing any attempts at restriction, etc., seem rather out of place at this late hour of the day, and in view of the inference which might be drawn, such action seems rather ill-advised. Be that as it may, it is safe to say there will be no necessity for any Munitions Tribunal in Canada.

It may be otherwise, however, as far as our factories administration is concerned. The organization of the Canadian Shell Committee, under the conditions which originally existed, has been repeatedly justified by the success of its efforts in the past. Changed conditions in Europe, and the certainty of a prolonged struggle with its attendant strain on Britain's resources should by this time, however, have prompted the responsible parties in this country to look upon the British Treasury as something better than a milch cow.

Few Canadian enterprises of national magnitude have enjoyed the glory of successful achievement without being accorded the doubtful honor of a commission of inquiry, and Canada's reputation as a loyal and efficient member of the British Empire would suffer immeasurably should the self-sacrifice and effort of the people as a whole be nullified in the slightest by the failure of men in high positions to realize that their main duty now is to the Empire and not to themselves.

Latent selfishness is more dangerous than active opposition, and should compulsion in the guise of controlled factories be brought about, many manufacturers will only have themselves to blame.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey forge, Pittsburgh	$14 70	
Lake Superior, charcoal, Chicago	15 75	
Ferro Nickel pig iron (Soo)	25 00	
	Montreal.	**Toronto.**
Middlesboro, No. 3	$24 00	.....
Carron, special	25 00	.....
Carron, soft	25 00	.....
Cleveland, No. 3	24 00	.....
Clarence, No. 3	24 50	.....
Glengarnock	28 00	.....
Summerlee, No. 1	30 00	.....
Summerlee, No. 3	29 00	.....
Michigan charcoal iron	28 00	.....
Victoria, No. 1	24 00	21 00
Victoria, No. 2X	23 00	21 00
Victoria, No. 2 plain	23 00	21 00
Hamilton, No. 1	23 00	21 00
Hamilton, No. 2	23 00	21 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	2.35
Steel bars, f.o.b., Toronto	2.35
Common bar iron, f.o.b., Montreal	2.35
Steel bars, f.o.b., Montreal	2.35
Twisted reinforcing bars	2.35
Bessemer rails, heavy, at mill	1.25
Steel bars, Pittsburgh	1.40
Tank plates, Pittsburgh	1.40
Beams and angles, Pittsburgh	1.40
Steel hoops, Pittsburgh	1.60
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.40
Small shapes	2.65
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.90
Structural shapes	1.95
Plates	1.95

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ¼ to ½ in., 100 lb.	$2 35	$2 25
Heads, per 100 lb.	2 55	2 45
Tank plates, 3-16 in.	2 60	2 45

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$12 25	$12 25
Copper, crucible	14 25	14 00
Copper, unch-bled, heavy	14 25	13 50
Copper, wire, unch-bled	14 25	14 00
No. 1 machine compos'n	11 50	11 50
No. 1 compos'n turnings	10 00	10 00
No. 1 wrought iron	10 00	9 50
Heavy melting steel	8 00	9 50
No. 1 machin'y cast iron	13 50	12 00
New brass clippings	11 00	11 00
No. 1 brass turnings	9 00	9 00
Heavy lead	4 50	4 50
Tea lead	$ 3 50	$ 3 50
Scrap zinc	10 50	9 50

W. I. PIPE DISCOUNTS.

Following are Toronto jobbers' discounts on pipe in effect Aug. 27, 1915:

	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
Standard				
¼, ⅜ in.	63	38½	....	....
½ in.	68	47½	....	....
¾ to 1½ in.	73	52½	....	....
2 in	73	52½	69	48½
2½ to 4 in	73	52½	72	51½
4½, 5, 6 in.	....	....	70	49½
7, 8, 10 in.	....	....	67	44½
X Strong P. E.				
¼, ⅜ in.	56	38½	....	....
½ in.	63	45½	....	....
¾ to 1½ in.	67	49½	....	....
2, 2½, 3 in.	68	50½	....	....
2 in.	....	....	63	45½
2½ to 4 in.	....	....	63	48½
4½, 5, 6 in.	....	....	66	48½
7, 8 in.	....	....	59	39½
XX Strong P. E.				
½ to 2 in.	44	26½	....	....
2½ to 6 in.	....	....	43	25½
7 to 8 in.	....	....	40	20½
Genuine Wrot Iron.				
⅜ in.	57	32½	....	....
½ in.	62	41½	....	....
¾ to 1½ in.	67	46½	....	....
2 in.	67	46½	63	42½
2½, 3 in.	67	46½	66	45½
3½, 4 in.	....	....	66	45½
4½, 5, 6 in.	....	....	63	42½
7, 8 in.	....	....	60	37½

Wrought Nipples.	
4 in. and under	77½%
4½ in. and larger	72½%
4 in. and under, running thread	57½%
Standard Couplings.	
4 in. and under	60%
4½ in. and larger	40%

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	60 & 10%
Sq. Head Set Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45%
Flat & But. Head Cap Screws	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in. N.	70%
Semi-Fin. Nuts up to 1 in.	70%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

METALS.

	Montreal.	Toronto.
Lake copper, carload	$20 00	$19 50
Electrolytic copper	20 00	19 25
Castings, copper	19 25	19 00
Tin	37 00	37 00
Spelter	18 00	17 50
Lead	6 15	6 25
Antimony	35 00	35 00
Aluminum	60 00	60 00

Prices per 100 lbs.

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh	$24 50
Openhearth bilets, Pittsburgh	25 00
Forging billets, Pittsburgh	34 50
Wire rods, Pittsburgh	32 00

NAILS AND SPIKES.

Standard steel wire nails, base	$2 60	$2 55
Cut nails	2 50	2 70
Miscellaneous wire nails	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	70-10
Stove bolts	80
Plate washers	40
Machine bolts, ⅜ and less	65-10
Machine bolts, 7-16 and over	57½
Blank bolts	57½
Bolt ends	57½
Machine screws, iron, brass	35
Nuts, square, all sizes	4c per lb. off
Nuts, hexagon, all sizes	4½c per lb. off
Iron rivets	72½
Boiler rivets, base, ¾-in. and larger	$3.75
Structural rivets, as above	3.75
Wood screws, flathead, bright	85, 10, 7½, 10 p.c. off
Wood screws, flathead, Brass	75 p.c. off
Wood screws, flathead, Bronze	70 p.c. off

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Standard. Price. per ft.	Extra Strong, Sizes Ins.	Extra Strong, Price per ft.	D. Ex. Strong, Size Ins.	D. Ex. Strong, Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....

COKE AND COAL.

Solvay Foundry Coke	$5.75
Connellsville Foundry Coke	5.00
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

COLD DRAWN STEEL SHAFTING.

At mill	30%
At warehouse	35%

Discounts off new list. Warehouse price at Montreal and Toronto.

MISCELLANEOUS.

Solder, half-and-half	0.22½
Putty, 100-lb. drums	2.70
Red dry lead, 100-lb. kegs, per cwt.	9.65
Glue, French medal, per lb.	0.15
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.20
Benzine, single bbls., per gal.	0.18½
Pure turpentine, single bbls.	0.70
Linseed oil, raw, single bbls.	0.77
Linseed oil, boiled, single bbls.	0.80
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.25
Lead Wool, per lb.	0.11
Pure Manila rope	0.16
Transmission rope, Manila	0.20
Drilling cables, Manila	0.17
Lard oil, per gal.	0.73
Union thread cutting oil	0.60
Imperial quenching oil	0.35

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto 40%

PROOF COIL CHAIN.

¼ in.	$9.00
5-16 in.	5.90
⅜ in.	4.95
7-16 in.	4.65
½ in.	4.40
9-16 in.	4.05
⅝ in.	4.30
¾ in.	4.15
⅞ inch	3.65
1 inch	3.45

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	55
Carbon over 1½ in.	25
High Speed	
Blacksmith	55
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Centre	25
Pipe Reamers	80

Discounts off standard list.

IRON PIPE FITTINGS.

Canadian malleable, A, 25 per cent.; B and C, 35 per cent.; cast iron, 60; standard bushings, 60 per cent.; headers, 60; flanged unions, 60; malleable bushings, 60; nipples, 75; malleable, lipped unions, 65.

TAPES.

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3.50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$3 00	$2 85
Canada plates, dull, 52 sheets	3 15	3 15
Canada Plates, all bright	4 75	4 50
Apollo brand, 10¾ oz. galvanized	5 50	5 30
Queen's Head, 28 B.W.G.	6 00	5 95
Fleur-de-Lis, 28 B. W. G.	5 75	5 75
Gorbal's Best, No. 28	6 00	6 00
Viking metal, No. 28	5 25	5 25
Colborne Crown, No. 28	5 70	5 80
Premier No. 28	5 10	5 00

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$14 25	....
1¼ in.	14 25	....
1½ in.	14 25	....
1¾ in.	14 25	....
2 in.	14 25	9 25
2¼ in.	15 50	10 50
2½ in.	16 50	11 50
3 in.	21 00	12 25
3½ in.	24 00	14 50
4 in.	29 50	18 50

Prices per 100 feet, Montreal and Toronto.

WASTE.

WHITE.	Cents per lb.
XXX Extra	0 11
X Grand	0 10½
XLCR	0 09¾
X Empire	0 09
X Press	0 08¼
COLORED.	
Lion	0 07½
Standard	0 06¾
Popular	0 06
Keen	0 05½
WOOL PACKING.	
Arrow	0 16
Axle	0 11
Anvil	0 08
Anchor	0 07
WASHED WIPERS.	
Select White	0 08½
Mixed Colored	0 06¼
Dark Colored	0 05¼

This list subject to trade discount for quantity.

BELTING RUBBER.

Standard	50%
Best grades	30%

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50%
Standard	50 & 10%
Cut leather lacing, No. 1	$1.20
Leather in sides	1.10

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	$9.50
¼ in.	6.55
5-16 in.	5.20
⅜ in.	4.25
7-16 in.	4.00
½ in.	4.00

Prices per 100 lbs.

PLATING CHEMICALS.

Acid, boracic	$ .15
Acid, hydrochloric	.05
Acid, hydrofluoric	.06
Acid, Nitric	.10
Acid, sulphuric	.05
Ammonia, aqua	.08
Ammonium carbonate	.15
Ammonium chloride	.11
Ammonium hydrosulphuret	.35
Ammonium sulphate	.07
Arsenic, white	.10
Copper sulphate	.10
Cobalt Sulphate	.50
Iron perchloride	.20
Lead acetate	.16
Nickel ammonium sulphate	.10
Nickel carbonate	.50
Nickel sulphate	.15
Potassium carbonate	.40
Potassium sulphide (substitute)	.20
Silver chloride (per oz.)	.65
Silver nitrate (per oz.)	.45
Sodium bisulphite	.10
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.35
Sodium hydrate	.04
Sodium hyposulphite (per 100 lbs.)	3.00
Sodium phosphate	.14
Tin chloride	.45
Zinc chloride	.20
Zinc sulphate	.08

Prices Per Lb. Unless Otherwise Stated.

ANODES.

Nickel	.47 to .52
Cobalt	1.75 to 2.00
Copper	.22 to .25
Tin	.45 to .50
Silver	.55 to .60
Zinc	.22 to .25

Prices Per Lb.

PLATING SUPPLIES.

Polishing wheels, felt	1.50 to 1.75
Polishing wheels, bullneck	.80
Emery in kegs	4½ to .06
Pumice, ground	.05
Emery glue	.15 to .20
Tripoli composition	.04 to .06
Crocus composition	.04 to .06
Emery composition	.05 to .07
Rouge, silver	.25 to .50
Rouge, nickel and brass	.15 to .25

Prices Per Lb.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., Oct. 25, 1915.—The demand for steel products still continues, a substantial advance in many specialties being one of features of the past week. While the demand for steel bars and billets for the production of munitions is admittedly the most insistent ,various other lines are also in strong request by metal working plants. The scarcity of supply of seamless tubing has started an upward trend in the quotations on this commodity.

Metals

Metals generally are holding firm and quotations show little change from the previous week. A few export inquiries have been received for copper, but the general dullness has a tendency to shade prices.

Tin remains firm at previous quotations.

Spelter shows some improvement, and producers are refusing to sell futures as freely as they were a week ago.

Quotations on lead are unchanged, the market showing a slight increase in activity. Antimony is being contracted for in considerable quantity for future delivery.

Machine Tools and Supplies

The situation as regards machine tools is unchanged. Delivery of long ordered equipment still lags and, of course, causes more or less inconvenience. In many cases, where it was impossible to secure the desired machinery, acceptance was made of tools that were considerably larger than those required for current needs. This may ultimately turn out to have its compensations, for, while fulfilling the present requirements, they may also supply those of the future if the opportunity offers of manufacturing larger shells than those now being produced.

Supplies naturally are also in active demand, with prices at least firm.

Sheets

The slight increase in the demand for galvanized sheets is keeping prices firm. The supply is considerably below normal; however, an improvement in this respect is anticipated in the near future.

Old Material

A steady improvement is shown in the demand for scrap metals, and, while prices are meantime little more than steady, indications point to an advance shortly, due to some mills requiring additional scrap sooner than they expected.

There is little demand for foundry scrap, and prices are weak.

Toronto, Ont., Oct. 26.—The general improvement in trade continues and an optimistic spirit prevails in business circles. The crops, which are an important factor in the development of this country, have been so bountiful this year that they will add materially to the wealth of the community generally and inspire a greater feeling of confidence in manufacturing circles. In addition, the large volume of war orders will contribute to place many of our industries on a very satisfactory basis. The trade returns for six months ending Sept. 30 are very encouraging. The figures show a satisfactory advance over the corresponding period of last year. The export of manufactured goods for September was very heavy, reaching a total of over nine million dollars compared with a total of a little over five millions for Sept., 1914. Imports also showed an improvement. The duties collected on imported goods show an increase of approximately one and one-half million dollars for the six months compared with the corresponding period of 1914.

> **CANADIAN GOVERNMENT PURCHASING COMMISSION**
>
> **The following gentlemen constitute the Commission appointed to make all purchases under the Dominion $100,000,000 war appropriation:—George F. Galt, Winnipeg; Hormidas Laporte, Montreal; A. E. Kemp, Toronto. Thomas Hilliard is secretary, and the commission headquarters are at Ottawa.**

Developments in the shell industry are being awaited with the greatest interest. A new system of placing contracts for the large calibre shells will be introduced. Canadian manufacturers are being asked to submit tenders for 6-in., 8-in. and 9-in. shells, thus placing the business on a competitive basis. It is reported that orders amounting to $80,000,000 for the larger shells are about to be placed by the British Government through the Shell Committee.

Steel Market

A general advance in prices is the principal feature of the steel market this week; the heavy demand has had this natural effect. All indications point to a still heavier demand and also to higher quotations. Canadian mills have raised their quotations on iron and steel bars to $2.35 base per 100 lbs., representing an advance of 10c. Reinforcing bars are now quoted at $2.35 base. plus extras for twisting. Warehouse prices are higher in proportion. Pittsburgh bars, plates and small shapes for Canadian consumption are now being quoted at 1.40c and steel hoops at 1.60c, Pittsburgh.

Wire has advanced 15c and is now quoted at $2.75 base. Wire nails are up 10c and are quoted at $2.55 per keg. Quotations on proof coil chain and electric weld coil chain are higher. Prices on wrought iron pipe are very firm and are expected to advance any time. With the market in the present uncertain condition, prices are liable to fluctuate, and in some cases orders can only be accepted subject to immediate acceptance. The enormous demand for steel for munitions has been chiefly responsible for the present conditions in the market. Steel plants are working to capacity to meet the demand. and this will increase as the shell industry expands and as orders for domestic steel products increase in volume.

Prices of high-speed tool steel continue to advance and the situation is becoming more acute. The most serious feature is the difficulty of obtaining supplies in anything like the quantity required. The demand has practically doubled owing principally to the necessity of having high-speed tool steel for machining shells. Some producers have withdrawn from the market, while others are only able to supply their customers with comparatively small quantities. The scarcity of tungsten, which shows no improvement, is the cause of all the trouble. Other alloys have advanced in price, as have also the cost of crucibles, labor, etc.

The galvanized sheet market is quiet, there being only a moderate demand, but prices are being maintained. Black sheets are advancing and spelter is too high in price to create much interest among galvanizers. Bessemer black sheets have advanced $2 a ton, and No. 28 gauge are now being quoted at 2.10c Pittsburgh.

The heavy demand for steel products in the States continues, and prices of finished iron and steel are steadily advancing. There is no abatement in the heavy demand for large rounds for shell manufacture. and the steel mills are sold up for the remainder of the year. Prices of steel bars. plates and shapes have advanced to 1.45c Pittsburgh. There is a continued heavy demand for open-hearth and forging billets on which prices are very strong on the advance. Forging billets are now quoted at $34.50, open-hearth billets at $25 and Bessemer billets

From Illuminating Gas to Russian Shrapnel

A more complete transformation than that involved in changing from illuminating gas manufacture to shrapnel shell production would be difficult to imagine. That such a change has been made, quickly and successfully is additional assurance, if any be needed, of Canada's ability to adapt her industrial resources to any required line of activity.

Staff Article

ALTHOUGH much has been written and said about the manufacture of shells in connection with the British War Office contracts, comparatively little has become known regarding French and Russian shrapnel, large orders for which are now in course of execution in this country.

While the various types of shrapnel are more or less similar in their general features, there are some points of design in which considerable divergence is noticeable.

The Lachine Manufacturing Co. of Lachine, Que., was the first plant in Canada to undertake the production of Russian shrapnel. This firm, who had been for several years manufacturing illuminating gas for various purposes, some time ago commenced the manufacture of Russian 3-inch shrapnel shells. Operations were at once commenced and such good progress made, that within four months they were working on the semi-finished product. When it is considered that buildings had to be erected and every tool secured and installed, it makes the achievement all the more remarkable.

The Building

The building is of solid brick construction, 112 feet by 100 feet and 25 feet high, with structural steel mill roof, covered with 1½-inch planking. The floor is of solid concrete. The shop is well lighted from three sides and also by a large sky-light extending the full length of the building; artificial light is supplied by 44 nitrogen lamps, being one 250 e.p. light for every 250 sq. ft. of floor space.

The building, which is steam heated, was completed in 15 days, and the time of laying the concrete floor was 3 days.

A general view of the machine section is shown in Fig. 1, while Fig. 2 is a plan of the machine layout.

Trimming End and Centering

The first operation on the rough forging is sawing off the open end. This is done in 4 Racine Tool & Machine Co. high-speed metal cutting machines. The shells are then taken to a 15¼-inch Carrol-Jamieson lathe, placed on a mandrel held in the lathe spindle, and the base of the rough shell centered.

Rough Turning

The third operation, rough turning the outside diameter, is performed on a Butler 22-inch gap lathe; one C. M. C. 22-inch gap lathe; 2 R. McDougall lathes, 22 inch gap and 20 inch, and two Rahn-Larmon 20-inch lathes. The shells are placed on a fluted arbor and the outside diameter roughed off over the complete length.

Facing Base

Facing off the base is the fourth operation; this is done on a 30-in. x 30-in. x 10-ft. C. M. C. planer, as shown in Fig. 3. The capacity of the machine is 80 shells per load. The shells are set up in the jig, and base roughed off (leaving 1-16 inch surplus stock over finished dimensions) with both heads working, and the shells removed in one hour and a half, which gives a total of 530 shells in ten hours. The general design of the jig can be clearly seen by referring to Fig. 4. The jig A is secured to the planer table and the gauge studs B are screwed into the base and locked by the nut shown. The shells C are then placed on the studs and clamped firmly up in the vees of the jig by the clamps D.

Heat Treating

Tempering, annealing and scleroscope testing is the next operation. This is done in a room at the rear of the main building and the arrangement of the equipment is shown in Fig. 5. The two furnaces in the background are for hardening and tempering the shells, and were supplied by the Strong, Carlisle & Hammond Co. of Cleveland, Ohio.

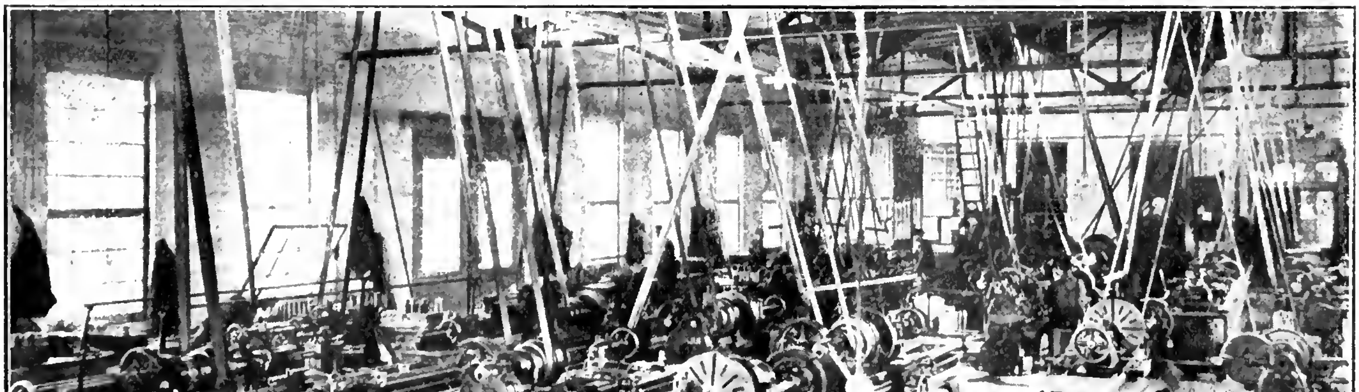


FIG. 1 GENERAL VIEW OF MACHINE SHOP

To the front of the hardening furnace is shown the quenching bath; the oil is kept in circulation by the pump shown at the top left-hand edge of the tank. The blower which supplies blast to the various furnaces is driven by a 10 h.p. motor, supplied by the Canadian Crocker-Wheeler Co. of St. Catharines. The furnace to the extreme right was installed for heating the nose in preparation to closing-in, but this was found unnecessary, as very satisfactory results could be obtained by closing the nose while cold.

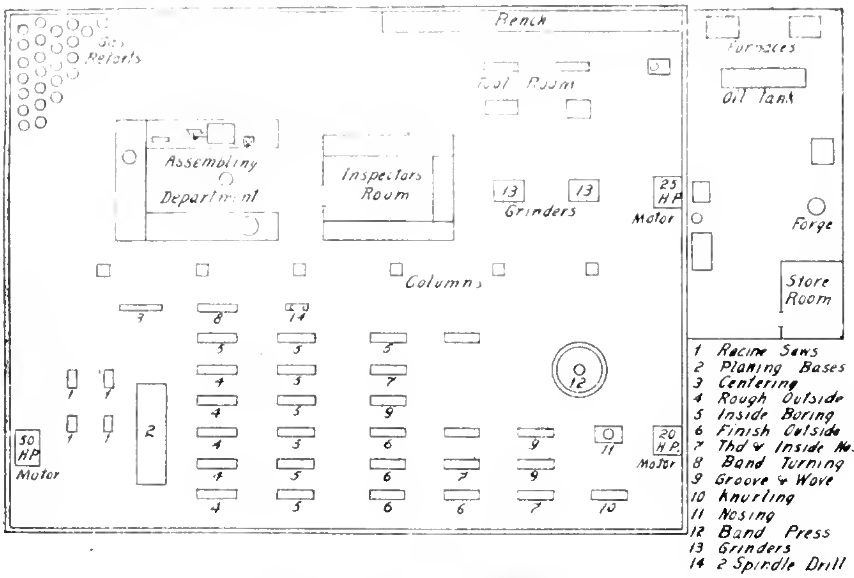


FIG. 2. LAYOUT OF MACHINES

Quenching Bath

A sketch of the quenching bath is shown in Fig. 6. Within the main tank A is placed the inner tank B which contains the oil for cooling the shells. This oil is kept in circulation by means of the pump E, which is driven from a shaft overhead. The oil is drawn up through the pipe F into the pump, and forced through the pipe G, and the coil H and into the tank again at the opening I. This water in the outer compartment A is also kept in continual circulation, entering from the feed pipe J and overflowing from the discharge pipe K.

Inside Boring

After the shells have been heat treated and tested for hardness they are taken to the 6th operation, which is boring and forming powder chamber and diaphragm seat. The lathes on this operation are one Rahn-Larmon, one Walcott and Wood, 3 Boyé and Emmes and one Walcott; all of these are 20-inch engine lathes fitted with special turrets designed and constructed in the shop. These special turrets, which are giving excellent satisfaction, are used on a large number of the engine lathes in the shop, as the work in this plant is being performed without the aid of any standard make of turret lathe or machine.

The cycle of operations at this stage is chucking, rough bore, rough powder chamber and diaphragm seat, finish diaphragm seat and face off open end, rough taper and finish taper. This operation of roughing and finishing the taper bore is performed by solid reamers as shown in Fig. 7.

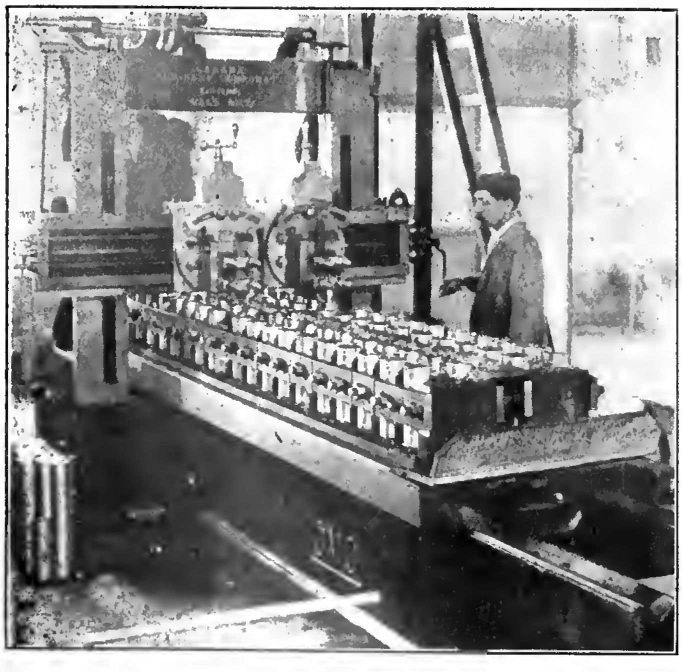


FIG. 3. FACING OFF BASES ON PLANER

Special Turret

Fig 8 shows a sketch of the special turret designed and constructed in the shop. The base A is secured in a central position on the lathe saddle; this base is recessed out to receive the revolving turret B, which is held in position by the ring C; this ring is secured to the base by the bolts D. In the bottom of the turret B six equidistant holes are drilled and a steel bush E inserted; the locating pin F is kept in position by the spring G. The lever I, pivoted at J, passes through the piece H, which is fastened to the lower end of the locking pin, F. The flow of the cutting compound is automatically controlled by the position of the turret, the liquid flowing only when operating tool is in position. The fluid enters the base of turret by means of the pipe K and flows through to the passage N, thence to the tubes O, which pass along a groove in the shank to the outer end of the various tools. To avoid any undue leakage, the leather washer Q is placed in a recess and bears upon the lower surface of the revolving turret B.

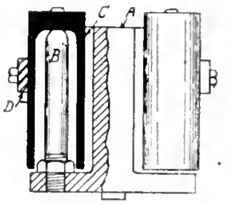


FIG. 4. JIG FOR HOLDING SHELLS ON PLANER

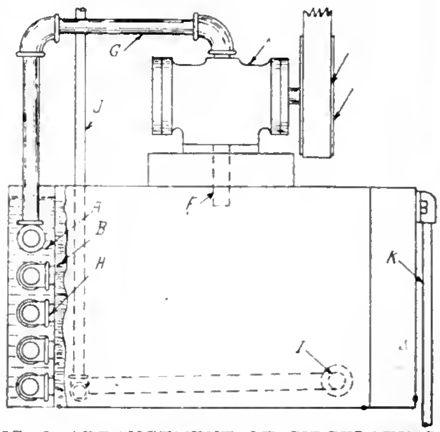


FIG. 6. ARRANGEMENT OF CIRCULATING PUMP AND COILS IN QUENCHING TANK

Self-tightening Chuck

Fig. 8A shows a special self-tightening chuck used extensively in this shop. Body A is screwed on to the lathe spindle; collet B, which has three equidistant slots milled in the nose, is checked into piece A as shown. A tapered sleeve C formed of three pieces of hardened tool steel grips the body of the shell when chuck sleeve D is screwed upon body A. Any slippage of the shell in the chuck now causes collets B and C and sleeve D to turn, thus causing the tapered nose of sleeve D to tighten on

C and increase the gripping force accordingly.

Groove and Base Finishing

When the inside of the shells are finished, they are taken to two Rahn-Larmon 20-inch engine lathes, where the copper band groove is cut, sides undercut, small groove for cartridge case is put in, base diameter finished below copper band groove, base faced and corner rounded. This operation is shown in Fig. 9; the turning and facing operations are performed by the tools held in the special four-sided turret tool box shown at the front of the saddle, while the undercutting of the groove faces are made by the device secured at the back end of the cross-slide. The ball-bearing hollow centre shown in the tail-stock spindle supports the end of the shell while the groove is being turned. These special tools, as well as the expanding mandrel, were all designed and built by the superintendent and shell shop forman.

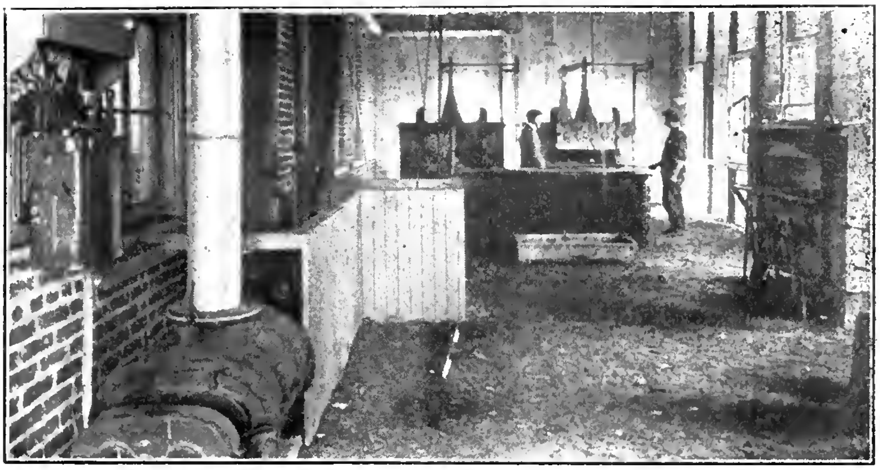
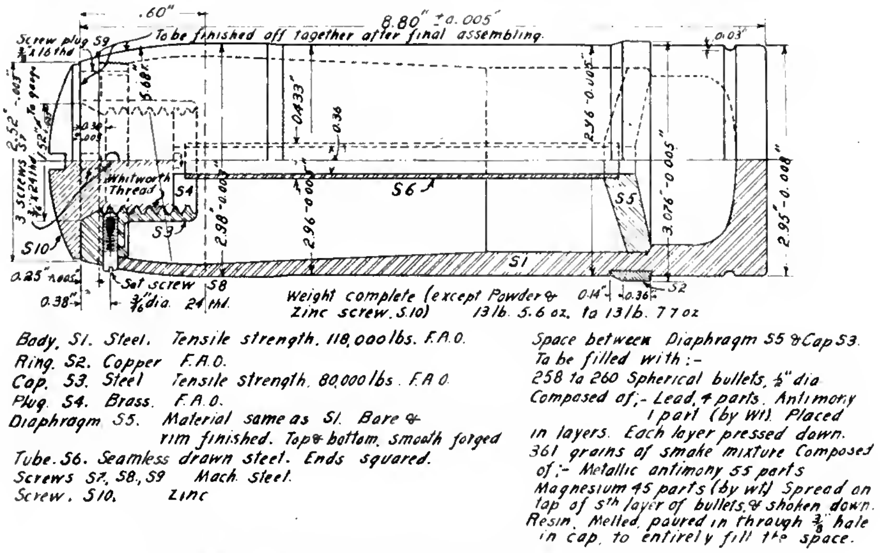


FIG. 5. VIEW OF HARDENING ROOM. HEATING FURNACES IN BACKGROUND



RUSSIAN 15-PDR. SHRAPNEL SHELL WITHOUT FUSE NOSE.

Undercutting Device

The device for undercutting the sides of groove is shown in sketch, Fig. 10. This is built of a flat plate provided with two grooves machined at the proper angle in which slide tool carriers A and B. These carriers have a number of rack teeth cut to engage with pinion C which when oscillated by the lever D brings either tool into operation as desired. Adjusting stops are provided at the outer end of each tool carrier as shown, and also a positioning stop for the shell.

Tool carriers A and B are a good close sliding fit in their respective grooves, and are retained in position by suitable keeper plates fastened to the main casting.

Knurling for Copper Band

It was originally intended to knurl the copper band groove at the same setting as that for turning, but owing to the great pressure required it was thought advisable to reverse the shell, thereby bringing the copper band groove closer to the head-stock bearing. The base of the shell is held in a special chuck and the open end run in a special centre in the tail-stock spindle.

During this setting the outside diameter, from the rifling groove to the open end, is finished turned to two diameters, the main portion of the shell being 2.96 inches diameter, while a short section back of the nose contour is left 2.98 inches; two Mueller 16-inch engine lathes are used for this operation.

Cold Nosing

The ninth operation, that of cold nosing, is performed on a Brown-Boggs No. 320A geared straight-sided press. As previously stated, it was thought that the open end of the shell would require heating to close the nose to the desired shape, but as the wall of the Russian shrapnel, at the open end, is lighter than that of the British shrapnel, and also requires less reduction in diameter, several shells were nosed cold and thoroughly tested; the result showing that the cold nosing, while being equally satisfactory in quality, is also much more economical.

Finishing the Nose

The nose being formed, the shells are taken to one 18-inch and one 20-inch Greaves-Klusman engine lathes and one Rahn-Larmon 18-inch engine lathe; these lathes are fitted with the special turret as shown in Fig. 8. The sequence of operations on the nose are: finish outside contour, cut thread, form inside contour and face end to length. A point bearing on a cam at the rear of the saddle guides

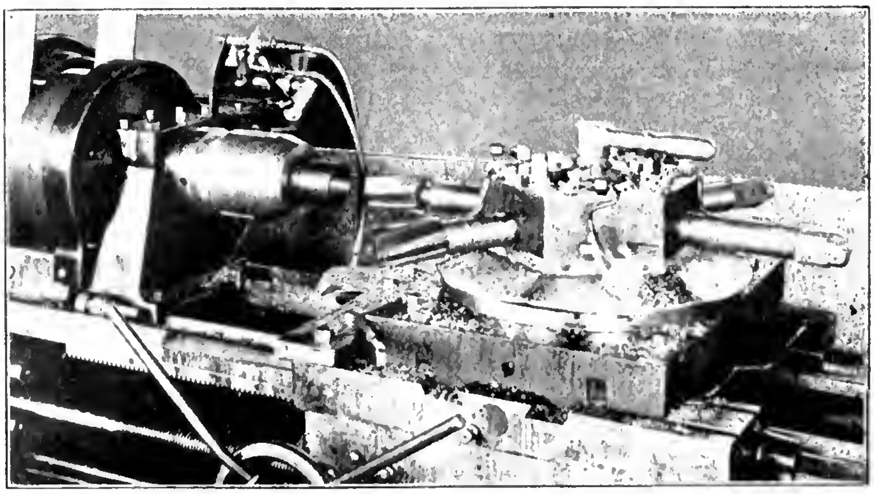


FIG. 7. SPECIAL TURRET FITTED TO ENGINE LATHE

the movement of the cross-slide while the contour of the nose is being formed.

Outside Grinding

At present the outside diameter is being finished by filing, but two Ford-Smith grinders are being installed to take care of this operation. The power required to run these grinders will be supplied from a single Crocker-Wheeler motor of suitable power.

Copper Banding

The shells are now ready to have the copper band put on. This operation is performed on a Canadian Fairbanks-Morse banding press.

The shells are held in a special chuck on a Greaves-Klusman 18-inch engine lathe while the copper band is turned, the base being supported in a special

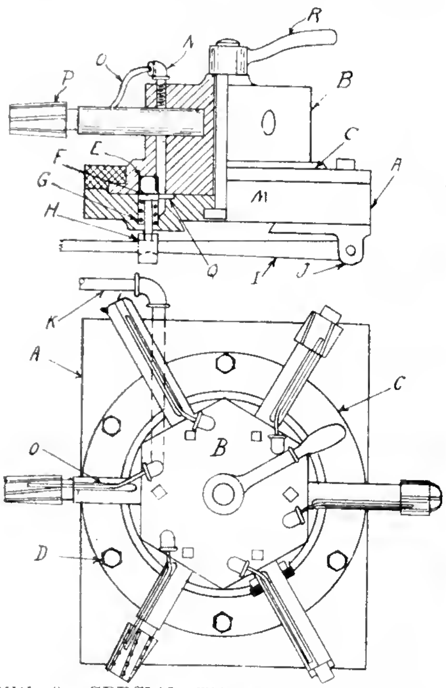


FIG. 8. SPECIAL TURRET FOR USE ON REGULAR ENGINE LATHES

ball-bearing cup centre. This operation is shown in Fig. 11. The special chuck is secured to the lathe spindle, and to insure added rigidity is run in the steady-head shown; this steady rest has a bearing of babbitt metal. The shell is held by closing the split chuck by means of the two-piece clamp.

Painting

The shells are now taken to a paint spraying arrangement where the inside receives two coats. The diaphragms are also thoroughly coated by dipping in a bath of paint.

Assembling

The steel tube and diaphragm are then placed in position and taken to the tables shown in Fig. 12, where the charge of powder, bullets, resin, etc., is put in. The process of charging these shells differs considerably from that of the British shrapnel. When the tube and diaphragm

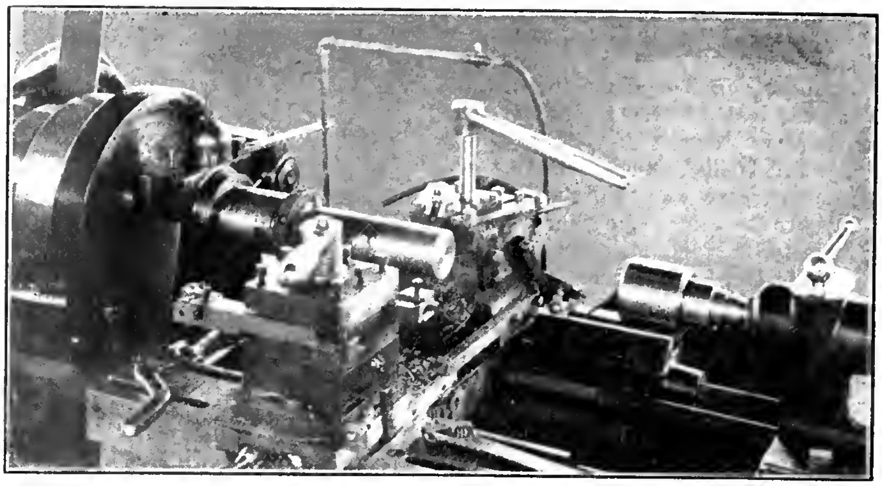


FIG. 9. CUTTING GROOVE AND FINISHING BASE ON SPECIALLY EQUIPPED ENGINE LATHE

are in position a charge of 90 bullets with a small quantity of smoke powder —13 drs. 5 grs. of 55 per cent. magnesium and 45 per cent. antimony—is placed in and pressed firmly down by means of the 20-ton Weaver screw press, shown to the right of Fig. 13; after this first charge of 90 bullets has been pressed in, a second lot of 50 bullets are poured in and pressed firmly down; a third lot of 50 is put in and pressed and a fourth lot of 50 similarly treated. This makes a total charge of 240 bullets.

To bring the shell up to the required weight it is necessary to add from 6 to 9 loose bullets as the specifications call for a charge of 240 bullets with a supply of 310 grains of smoke powder. A small quantity of heavy No. 1 petrolatum is used on top to hold the shot in position.

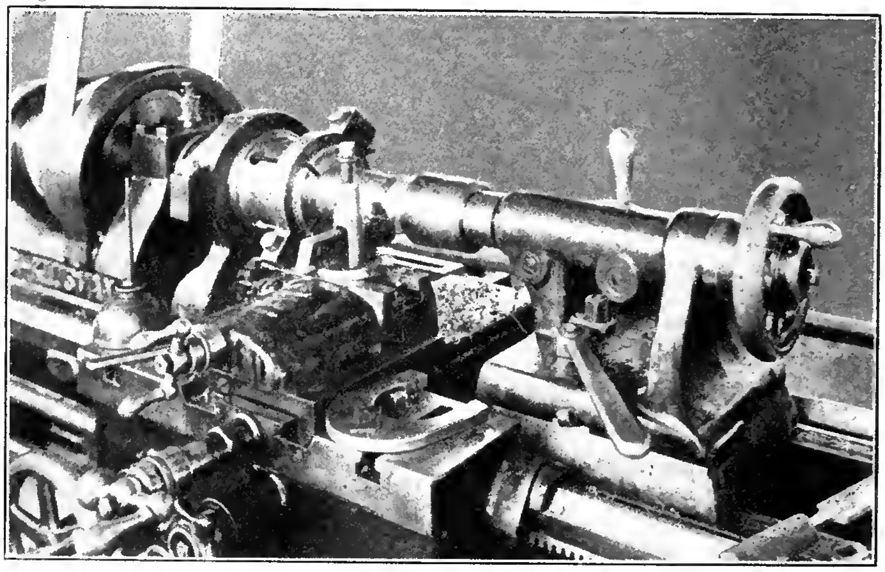


FIG. 11. TURNING COPPER BAND

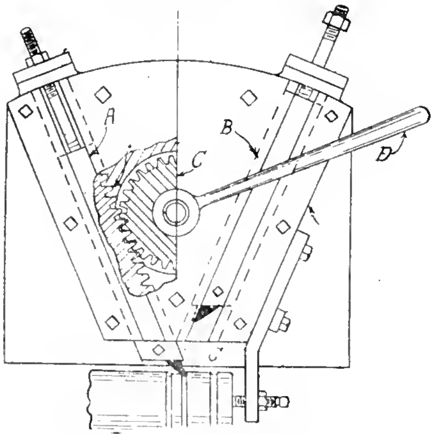


FIG. 10. UNDERCUTTING FIXTURE

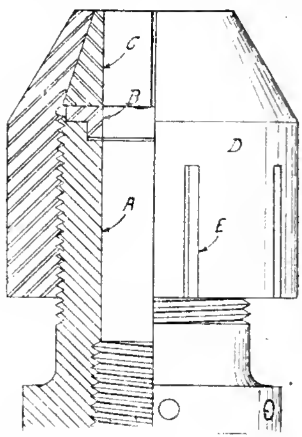


FIG. 8A. SELF-TIGHTENING CHUCK

FIG. 12 CHARGING DEPARTMENT SHOWING BULLET HOPPER, POWDER TANK, LOADING PRESS AND RESIN FURNACE

Fixing Cap and Tube

When the correct weight at this point has been obtained, the steel cap is screwed firmly into the nose of the shell. In place of securing the top of the powder tube to the cap by solder (as is done in the British shell) a small brass plug is screwed firmly down upon the upper end of the tube.

Through the cap or socket are two tapped holes: a smaller air vent hole, and one a little larger, through which the melted resin is poured into the shot chamber; these holes are then plugged.

Shot Filling Arrangement

The arrangement of these various operations can be clearly seen in Fig. 12. The shot tank shown to the extreme left is filled with bullets, and the spout is so designed that a chamber at the mouth is enclosed by two slides. This chamber will contain an average of 90 bullets at each charge. The large elevated tank shown in the centre contains another supply of bullets; the S-shaped pipe to the left ends in the filling arrangement which is shown in detail in Fig. 13. This device is so designed that 50 bullets are transferred from the feed pipe to the shell at each movement of the lever.

In the position shown, the bullets fall down through the pipe I into the piece F, which contains, when full, 50 bullets; the lever G is then swung over until the piece F is over the hole J in the lower plate B, when the bullets fall into the shell K placed below. The plate C, which is secured to the piece F, moves with it and closes the opening from the pipe I until the lever G is brought back to the previous position. The Weaver screw-press is seen in the foreground, and the resin tank is shown to the extreme right.

Powder Hopper

Midway between the two bullet tanks is the galvanized iron receptacle which contains the smoke powder that is placed in the shell with the first charge of 90 bullets. The small funnel-shaped measuring device is shown resting on the edge of the box. A sketch of this powder box and measure is shown in Fig. 14. The hopper is filled at B and the powder passes down into the box A where it is dipped out by the small measure F. The gauge or scraper E, secured to the cover C, is used for removing the surplus powder from the top of the funnel F, which when filled level with the large end contains the exact quantity of the smoke powder.

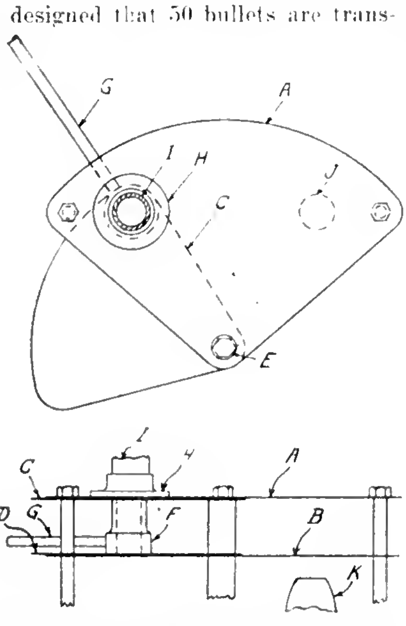


FIG. 13. BULLET MEASURING DEVICE

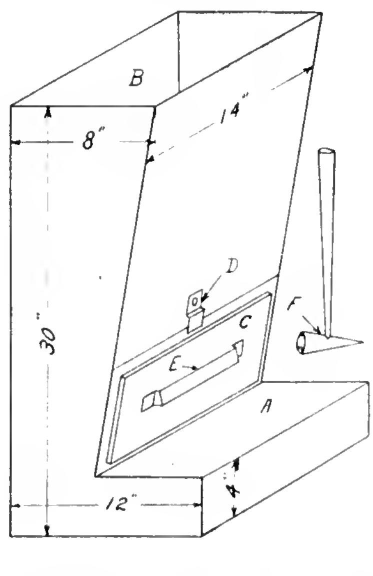


FIG. 14. POWDER TANK WITH MEASURE

Finishing Nose

When the shells have been filled and the cap and plug screwed in, three holes are drilled through the nose. These are tapped for 3-16-inch headless set-screws. Two of these are to secure the cap or socket, while the third is drilled and tapped through shell nose and cap to hold the time fuse in position.

The extending parts of the screws are then filed off and the nose of the shell and cap finished by polishing. The shells are then lacquered by applying lacquer with a brush while the shell is revolving between centres on a lathe.

ALL modern explosives, no matter what their base, depend upon nitric acid or nitrates. Common black powder contains saltpetre, which is nitrate of potash. Smokeless powders are nitro-cellulose. The higher explosives are trinitroglycerine, trinitrotoluene, trinitrophenol, etc.

In normal times these are made from the actual nitrates, most of which comes from Chile. But the Chilean deposits have not sufficed to supply the enormous demand made by agriculture and the arts in recent years, and now that thousands of tons are needed for explosives, the demand has multiplied many times over.

Therefore, it has been necessary to draw nitrogen from the air, where it exists in inexhaustible quantities. Nitrogen at a high temperature combines with many other elements. This was discovered only a few years ago, but already more than $100,000,000 is invested in factories where the process is used for making nitric acids. The chief of these are in Norway, Sweden, Switzerland and Germany, in each of which countries there is an abundance of water power.

There are several processes, the earliest of which was invented by Birkeland and Eyd. It consists of making the nitrogen and the oxygen of the air combine by using the electric arc. This is the process used at Notodden, Norway, where 280,000 tons a year are produced.

By this process the gases have to be cooled to a very low temperature to prevent the bioxide of nitrogen from decomposition.

CALIFORNIA has the longest electrical transmission line in this country, a current of 150,000 volts being transmitted a distance of 240 miles, from Big Creek to Los Angeles.

Sheet Metal Elbows: Their Development and Laying Off-III

By J. W. Ross

In order to thoroughly understand the principles involved in the development of cylindrical and other forms, such as are met in sheet metal work, a considerable knowledge of geometry is desirable. Through the medium of these articles, the author places practical examples at the disposal of our readers, and the knowledge to be gained by a close and persistent study of the principles and methods employed will well repay the time spent.

ELBOW OF CLINKER COURSES

IN Fig. 14 is shown the elevation view of a five-coursed 120-degree elbow of ½-in. plate. This system of fitting the courses is generally termed "telescopic" plating; it should be more correctly called "clinker" plating.

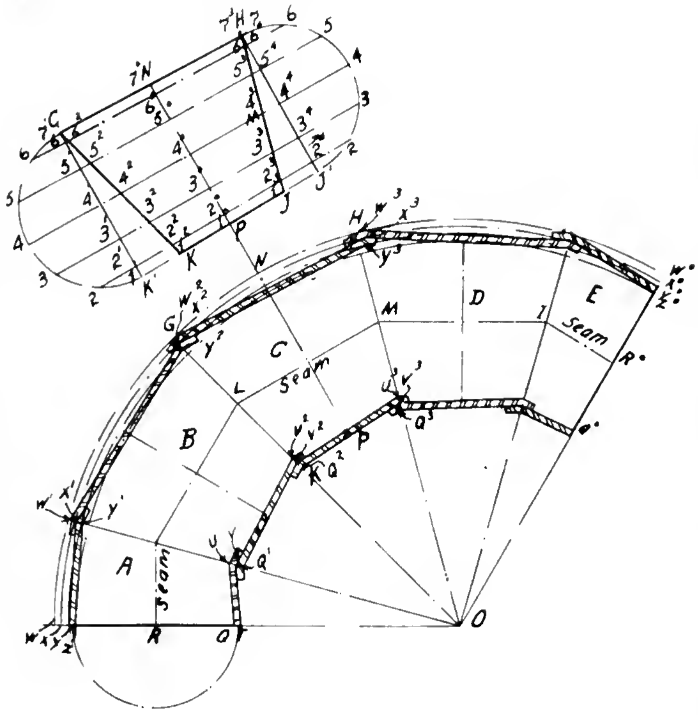
It will be observed that the end of one course fits over, whilst its other end fits in; thus each course will be conical in form.

Many platers prefer to lay this out by triangulation, which is generally too slow for most problems. Again, some prefer approximate methods which certainly give a quick layout, but much time is wasted and the work generally poor, when the courses are being fitted and lined up for riveting, very often the holes being unfair and completely "blind."

The method given below of developing this type of elbow is much superior and quicker in every way than that of triangulation or approximate methods. Triangulation will be dealt with in a forthcoming isue. The student may then use the method suitable to his own ideas. It was stated that each course was conical; therefore, it will be developed on the principle as described for cones—that is, by radial lines. The method of constructing the elevation view is different to the preceding problems.

Measure off OR, Fig. 14, equal to 36 inches, and RQ, RZ each equal to 9 inches; thus the inside diameter of the elbow will be 18 inches at ZQ, Fig. 14. With O as centre and OR as radius, strike the arc RR^0. Construct the angle ROR^0 equal to 120 degrees. Mark off YZ, YX and XW each equal to the thickness of the plate. With each of these points as radii to the centre O, strike in the arcs ZZ^0, YY^0, XX^0, and WW^0. The mitre lines are obtained as previously explained.

Each of the end courses equals one, and each of the intermediate courses equals two. According to the drawing, the courses A and E equal two, while BCD equals 6, making the sum of 8. Now, 8 divided into 120 degrees equals 15 degrees. By dividing the arc WW^0 into 8 equal parts and connecting these points by straight lines to O, the mitre lines are located. Draw RS at right angles to ZRQ. With the dividers set to the distance OS, mark off the points OL, OM, and OI on the mitre lines. Connect these points by straight lines, as S to L, L to M, M to I and I to R^0; these lines will be tangent to the arc RR^0.



FIGS. 14 AND 15.

To show a cross section of the plate thickness, connect Z to Y^1 and Y to X^1. Y^1 and X^1 are of course the intersections of the mitre line. So with the arcs YY^0 and XX_0. Similarly connect X^1 to Y^2 and W^1 to X^2; also proceed with the remaining lines that are drawn in, as shown on the arc ZZ^0, YY^0, XX^0, WW^0, Fig. 14.

The throat thicknesses are next drawn in. Mark off QT equal to the plate thickness. With dividers on S and distance SY^1 measure off SU^1, also SV^1 and SQ^1 equal respectively to SX^1 and SW^1. Connect Q to U^1 and T to V^1. In the same manner, with L as centre, the distances LY^2, LX^2, and LW^2 are transferred to LU^2, LV^2 and LQ^2 respectively. Connect V^1 to U^2 and Q^1 to V^2. Similarly proceed with the remainder of the construction.

By this method of construction, if the end courses EA were joined together they would conform to the courses B, C, or D. So if one of the intermediate courses is marked off, the end courses may be marked from the pattern.

The course C will, therefore, be developed; and to save confusion of the lines on this drawing the neutral lines of course C will be transferred over to Fig. 15. The heavy lines GHJK, Fig. 15, represent the neutral lines of course C, Fig. 14, or, which is equally the same, of the courses B and D. Parallel to the centre girth line PN draw from G the line GK^1, also from H the line HJ^1. Extend the line KPJ to the points K^1 on GK and J^1 on J^1H. Now, as will be seen, K^1GHJ^1 forms an ordinary frustum of a cone, so accordingly will it be developed. Bisect GK^1 at 4^1. With 4^1 as centre and 4^17—which is of course, the neutral radius—as radius strike the half-end view 147. Divide this into a number of equal parts and number accordingly. Project these points to intersect GK^1 at right angle. Bisect HJ^1 as at 4^4. With 4^4 as centre and radius 4^47, strike the half-plan view 147. Divide this into the same number of equal spaces, as in the view through GK^1.

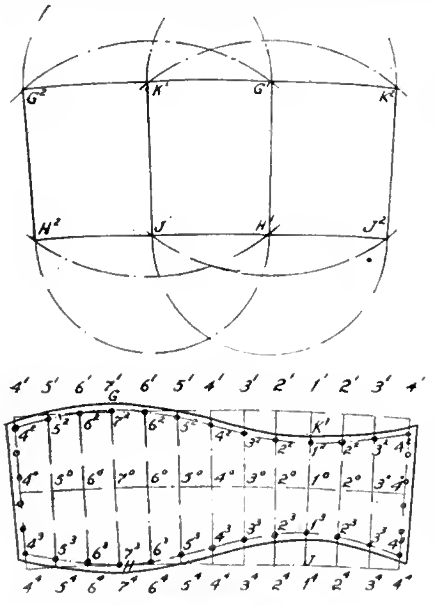
Number these points in the same consecutive order, and project lines from them to intersect HJ^1 at right angles. Connect points on GK^1 with corresponding points on HJ^1. The lines connecting these points will not be parallel, but will be radial, because HJ^1 is shorter than CK^1: GK^1, J^1K being part of a cone. Where these lines intersect the inclined lines GK and HJ, number as in Fig. 15.

For explanatory reasons only, the outline K^1GHJ^1 is transferred over to Fig. 16, as $J^1K^1G^1H^1$. With trammels or dividers on H^1 as centre and H^1K^1 as radius, strike the arc K^1K^2. With J^1 as centre and radius J^1G^1, strike the arc G^1G^2. With K^1 as centre, K^1G^1 as radius, strike the intersecting arc G^1G^2. Similarly with the same radius and G^1 as centre, strike the arc K^1K^2. Again, with K^1H^1 as radius, G^1 and K^1 as centres, strike the respective arcs J^1J^2 and H^1H^2. With J^1H^1 as radius and centres J^1 and

H^1, strike the intersecting arcs H^1H^2 and J^1J^2.

Draw an even curve through the points $G^2K^1G^1K^2$, Fig. 16, by the aid of a light wooden batten placed on the four points. In a similar manner draw in the curve through the points $H^2J^1H^1J^2$.

Again, for the benefit of instruction and to avoid a confusion of lines, Fig. 16 has been transferred over to Fig. 17, as shown by $4^14^14^1$ for the upper curve and 4^44^41 for the lower curve. Measure off from and on each side of 4^1—of the centre line 4^14^4—along the curve 4^14^1 a distance equal to half the neutral stretchout of the diameter 1^17^1, Fig. 15, which equals half of $22 \times 3.14 = 34\frac{1}{2}$ inches. The total of the stretchout for $4^14^14^1$ will be 69 inches. Similarly the stretchout for the lower curve will be $56\frac{1}{2}$ inches; therefore, half of this stretchout measured along each half of the curve from the central point 4^4 will locate the whole stretchout as enclosed



FIGS. 16 AND 17

by the points $4^14^14^44^4$. Divide 4^1 and 4^4 each into 12 equal spaces—that is, six spaces at each side of centre 4^1 and centre of 4^4, which is the number of spaces each half plan view is divided into in Fig. 15. These points on Fig. 17 are connected by straight lines and numbered accordingly. The curved centre line 4^0, 4^0, 4^0 is drawn equidistant to the curves $4^14^14^1$ and $4^44^44^4$.

As PN, Fig. 15, is equidistant from the inclined lines GK and HJ, therefore the distances 1^01^2, 2^02^2, etc., are equal respectively to 1^01^2, 2^02^2, etc. As both sides of the centre line PN are alike it will only be necessary to take one set of measurements to be transferred over to Fig. 17. These distances be measured from and at each side of the centre camber line $4^04^04^0$, Fig. 17.

Set the dividers to distance 1^01^2, Fig. 15; transfer this over to 1^01^2 and 1^01^3, Fig. 17. Proceed similarly by transferring over from Fig. 15 the distances 2^02^2, 3^03^3, etc., to Fig. 17, as 2^02^2, $2\,2^3$, 3^03^2, 3^03^3, etc. An even curve drawn through these points locates the rivet line and these points also indicate the rivet centres if desired. Divide the seam rivet lines 4^24^3, 4^24^3, each into the same number of rivet spaces. Twice the diameter of the rivet hole, measured from the rivet line, will give a suitable lap. For caulking purposes in water or steam-tight work, one and a half times the diameter of the hole will be more suitable for laps, the rivet holes, of course, being spaced according to the class of work.

Fig. 17 shows the complete pattern for courses B C and D. If the plate be cut on the line $4^04^04^0$, Fig. 17, the upper part would be the pattern for course E and the lower for course A.

MONTREAL HARBOR CONSTRUCTION WORK

AN inspection tour on October 18, by the three commissioners, Major David Seath, secretary; F. W. Cowie, chief engineer; M. P. Fennell, jr., and J. Vaughan, superintendent of railway terminals, revealed the fact that by the middle of next summer the permanent construction work of Montreal Harbor will be finished for that section of the port which stretches from McGill Street to the hay shed.

For some years the harbor work has been impeded to some extent by the very effort of the harbor authorities to bring the port up to an efficiency which would enable it to deal with the business which the West sends down to it. From next summer the problems of this part of the harbor will concern solely the administration of the facilities provided.

The commissioners on leaving their office proceeded to the place where the large addition to Elevator No. 1 is being constructed by the Fuller Construction Co. They expressed pleasure at the progress which had been made. The lower set of bins are now completed to the top, and the set on the shore side, which are about 19 feet higher, will be completed shortly. The whole thing will be covered in before the cold weather arrives, so that all through the winter work can go ahead with the installation of machinery and necessary interior work. The cupola will be on in a few weeks, and the commissioners were able to say after the inspection that the new building would be ready by the early summer of 1916.

Victoria Pier End

The commissioners also inspected the office building in its new position on the wharf, where it was moved to make room for the addition to Elevator No. 1. In the basement of this building the police department will be housed, as last year.

The last crib just put in place at the river end of Victoria pier has completed that pier, so far as its length is concerned. All that now remains to do is to build it up to the high level. Although this will not be accomplished this season, the work will be sufficiently advanced so that the winter ice will not damage it. Next year it will be finished in good time, and, when it is completed, Victoria pier will add about 2,500 lineal feet of harbor frontage to that available for ocean vessels, and 4,800 lineal feet along the inner side for lake and river vessels.

The commissioners and the departmental heads accompanying them afterwards proceeded by flat car along the higher level tracks of the harbor system down to the dry dock, to see what progress had been made with the filled-in land, and the extensions being made by the Canadian Vickers Co. The work done here has been little short of extraordinary, the activity being indicated by the fact that parts filled in only last summer are already built upon.

The party also traversed the high level tracks of the system, which have now been extended beyond Dominion Park, to connect ultimately with the Pointe aux Trembles wharf, built opposite the Canada Cement Co. premises. The flat car took the party almost down to Pointe aux Trembles, a sufficient indication of the progress of this extension of their railway system.

"Emden" Bombardment Effects.—An instance of the damage done to the German cruiser Emden by the Sydney's shots, states the Ironmonger, is to be found in one of the mementoes recently taken from the vessel. It is an oblong piece of metal, fairly smooth on one side, but on the other side presenting an appearance similar to that of a piece of jagged rock. It consists of a portion of the fireproof safe of the Emden and some silver dollars from a drawer of the safe. The explosion must have blown the dollars into the steel, and the heat of the flames which burst from the vessel shortly after the explosion melted the whole into a conglomerate mass of silver and steel. This gives a very clear indication of the conditions in those parts of the ship where the bombardment was most felt. It does not seem likely that much will be saved from those parts except for the melting pot or the foundry.

IT HAS been estimated that nearly fifty per cent. of the potential water power of this continent is available in the States of the Pacific Coast, or nearly twelve million horse-power.

CONTEMPORARY WAR ARTICLES

Embracing Information and Data Drawn from a Variety of Sources Relative to and Arising from the Prosecution of this Many-Sided European War

THE WORLD'S GREATEST ARSENAL

THE vast contracts received by various corporations in Canada and the United States have impressed most people by reason of the number of workers required to complete them, as much as by the value of the amounts involved. The fact that these contracts have been distributed over wide areas, has so detracted from their direct appeal to the general public, that an account of conditions pertaining in a restricted area like the valley of the River Clyde in Scotland is of absorbing interest to those of us engaged in munitions manufacture. The Glasgow Herald publishes the following particulars of wartime activity:

It must have been borne in upon every Clyde workman that the vast steel and shipbuilding area which exists between Motherwell and Dumbarton is one of the most extensive and important in the eyes of the nation. The Clyde area has become, indeed, the largest centre in the world for the production of war materials. This compliment is paid, notwithstanding the great developments which have taken place on the Tyne, at Barrow-in-Furness, Sheffield, Woolwich, etc. In the number of industries and the comprehensive scope of their productivity the Clyde has become the world's greatest arsenal. With the development of aircraft, too, the tendency must still be in favor of concentration on the Clyde and adjacent areas. The South of England is much too exposed to the menace of aircraft. Woolwich Arsenal and the Portsmouth and Devonport shipbuilding yards may be said to have seen their day. Once peace is concluded there will be an exodus for the north, where already some striking developments have begun in this direction, of which it is impossible here to speak. The Clyde is certain still more to outdistance all rivals in its importance as a naval and military centre of production.

Over 150,000 War Workers

It may surprise Clydesiders to discover the extraordinary number of men who are engaged locally in the shipbuilding and allied industries. At last census (1911) almost one-quarter of the males resident in Lanarkshire were engaged in such kindred trades. Lanarkshire's industries monopolized the labor of 212,482 males. Miners occupied premier place with 56,209 men employed, while the steel trade had 20,168 workers, and the engineering shops required the services of 20,145, and shipbuilding 14,528—a gross total of 54,841 in the steel and shipbuilding trades alone. This excludes Dumbartonshire, Renfrewshire, and North Ayrshire, all of which impinge on the Clyde munition area. Since the war began new munition factories have been laid down in many districts within the area, enormous developments have taken place in shipyards, gunshops, etc. Adding the men within the Dumbartonshire and Renfrewshire sections, plus the men engaged in the new workshops and factories, there cannot be less than 100,000 workers engaged in the Clyde area today on Government work, while the number of females may be set down at 5,000.

The Wages Bill—£600,000 a Week

Taking the men's wages at £3—an average balance between the smaller earnings of the unskilled laborer and the fat earnings of the skilled worker, swollen by abnormal overtime—this gives an influx into the Clyde area of £300,000 weekly in wages for the men, and, at £1 10s per head, the females take £7,500. In many cases unprecedented wage bills have been earned. Young, energetic fellows, having their time-sheets marked double time for Sunday labor, etc., have been known to earn £7 10s in a single week, while many steadily earn from £5 to £6. It is stated that one Clydebank family of five or six sons, plus the father—all skilled workmen—is earning £40 weekly—which is at the rate of £2,000 a year.

The total sum distributed by the Government in prosecuting the war is £4,500,000 daily, or £31,500,000 a week. It is well-known that in warships and war material the wage bill represents about one-half of the total cost (on battleships the wage bill is actually 60 per cent. of the total). On this basis, Clyde industries are receiving a total of over £600,000 weekly. In other words, almost one-fiftieth of the money expended by the nations on the war is finding its way into Clyde channels. This is proof, again, of the enormous importance of the West of Scotland to the nation—and the Allies—in the prosecution of this gigantic struggle.

A Shipbuilding Record

Leading up to this present-day abnormal development, the Clyde had already been for a number of years the largest and most comprehensive war arsenal in the world. For a long period it had been the largest warship-building centre extant. On the Admiralty List were five yards capable of producing battleships, while no other centre possessed more than two. For a number of years prior to the war the Scottish river had constantly on hand, in varying stages of construction, as many as four battleships of the Dreadnought type, representing, with a host of auxiliary craft, as much as £17,000,000 of taxpayers' cash. When Mr. Churchill visited the district several years ago he declared there were as many ships then building on the Clyde as represented the total fleet of a second-rate naval power. Since the Dreadnought era began the Clyde has completed the following battleships and battle cruisers—a list which roughly constitutes one-fourth of the total number of capital ships under the command of Admiral Jellicoe—the Colossus and Ajax at Greenock; Conqueror and Benbow at Dalmuir; Inflexible, Australia, and Tiger at Clydebank; and the Indomitable and New Zealand at Fairfield. There are certain other ships, about whose construction nothing may be said, however.

A Self-Contained Area

But it is in the multiplicity of its establishments that the Clyde leads the world. A battleship may be produced and equipped in every detail, everything being manufactured locally. There are immense gun shops, gun mounting departments, armor-plate shops, shell factories ad lib., a torpedo factory, and torpedo-testing range. The explosive works in our midst are the largest in the world. Then there is the highly technical establishment which produces range finders for guns. Every Navy extant has received some of Glasgow's products in this department—the British of course securing the specialties exclusively. Not even organized Germany can show a single centre with such multiplicity of warlike productivity.

The honor of leading the Clyde in this gigantic development of becoming the greatest naval and military arsenal in the world belongs to the firm of Wm. Beardmore & Co. It is very well known that the Parkhead establishment produces all kinds of weapons up to the largest naval guns in use on his Majesty's ships. Included amongst these are weapons for sisters of the Queen Elizabeth, completing "somewhere" in this country. The firm began its gun department ten years ago, on the personal initiative of its present head, Sir Wm. Beardmore, whose enterprise in this and other directions has proved a lucky asset for the nation to-day. Prior to the guns the Parkhead works had acquired great repu-

tation for their armor-plate. This involves the most complex metallurgical problem undertaken by steel manufacturers; and here, be it said, the product of Messrs. Beardmore stands unrivalled throughout the world. It is not generally known that until recently nearly all the English firms which produced armor-plate did so on a process invented and patented by Krupps, of Essen, to whom a royalty of 10s per ton was paid for license to work it. Messrs Beardmore never used this process. They adhered to their own methods, and by costly experimentation evolved a plate which is superior to the Krupp.

Universal Providers

During the Russo-Japanese war it was an odd coincidence that vessels engaged on both sides had materials in their hulls or engines which had come from Parkhead. The Russian battleship Petropavlovsk, which was sunk by a mine outside Port Arthur, had materials—engine, shafting, etc.—which were manufactured at Parkhead; while the Japanese battleship, to name one only, the Shikishia, had plates which were produced in Glasgow.

Messrs. John Brown & Co., Clydebank, come next to Messrs. Beardmore in the importance of their products for war. They built the Japanese battleship Asahi, which formed part of the squadron under Admiral Togo in the Sea of Tsushima when the Russian fleet was completely annihilated. Several years ago when on a visit to Glasgow, the Japanese naval commander paid a special tribute to the fine work of the Asahi in the greatest naval battle since Trafalgar. Messrs. Brown & Co., have at present the superintendence in Russia of one of the Government yards, where our Ally's new fleet is being prepared. One of their great successes has been achieved in turbine engine construction, developing the American Curtis system, and they have been favored with many Admiralty vessels designed for fast steaming. The Tiger battle-cruiser, the fastest in the world, came from this yard soon after war broke out.

In order to compete successfully with the great armaments firms of Vickers & Company at Barrow, and Wm. Beardmore on the Clyde, Messrs. John Brown & Co., combined with the Fairfield Company and the Coventry Ordnance Company, laid down a splendid factory at Scotstoun some years ago for the purpose of completing gun mountings. Messrs. Beardmore's is the only establishment on the Clyde which can completely build and equip a warship, while Messrs. John Brown & Co., and the Fairfield yard come next—a considerable distance behind, it must be admitted—in the multiplicity of their products and capacity to build and equip a battleship.

"BARGING ABOUT THE NORTH SEA"

WHEN Rear-Admiral Sir David Beatty, on a recent occasion spoke of the British Navy as "barging about the North Sea" (says the "Scotsman"), all who heard him realized the measure of the Navy's regret that there had been so much difference between what it wished to do and what it had been given an opportunity of doing. To sweep the seas of the world clean of the surface craft of the enemy within a few months, to impose upon his commerce a strangle hold, to fight land batteries and cover the operations of troops on distant coasts, to smash a way up tropical rivers, and edge over the shoals of a flat coast-line with great guns working mightily for the sake of a stricken people—these have been great achievements, but they have not satisfied the fleet. "The sure shield of Britain" has not failed her, and the utmost ingenuity of an absolutely unscrupulous enemy has been countered successfully and in silence. The whole world was made aware of the awful things which the German submarines would achieve, and now the whole world is aware that they have achieved practically nothing, and is almost imploring Britain to tell what she did to them. Such is the difference in method. The resounding phrases of the commission to the submarines of the enemy to "cleanse the North Sea" produced no evidence of disturbance over here. His underwater craft put out with injunctions of frightfulness showering upon them, and with impressed neutrals awaiting results, but they were just quietly gathered in, and the manner of their ending was a mystery to the Fatherland.

Opportunity Lacking

There has been lacking, however, the one great opportunity, as compared with which all the achievements indicated are regarded by the British Navy as of little moment. The enemy's fleet has remained locked away behind the minefields, and there has been no smashing contest such as would recall the famous days when the navies of nations fought. Deprived of the great test—the test which it believes would be final—the British Navy is disposed to look upon all else that it has done as mere "barging about."

It has been seen that "barging about" has included the reduction practically to impotence of the submarine service which the enemy had regarded as his most valuable sea weapon. It has included much more than that. If it were possible, indeed, to tell at this time all that "barging about" has meant, the gratitude and pride with which the nation—and not alone this nation—regards the Silent Service would be deeper than ever. The earliest days of the war were stirring days at sea. They seem far off now, and the lessons they provided have been well learned. Our Fleet at that time had yet to measure the infamy of the enemy, and to realize that to the German nothing was sacred but his success. There were some fine feats of seamanship during the first black, wild winter round coasts darkened and disguised, and amid courses mazed and mixed and falsified in "the blindfold game of war." Be it remembered that many of the ships of the Navy had been drawn across the world to the work on the lightless, shallow, narrow sea, where the enemy was assured that his mosquito craft from the harbors behind Heligoland would hunt at will. Sailormen will appreciate the seamanship which kept the ships in safety at their work, day and night, on such coasts, under such conditions. Efficiency and accuracy in the engine-room; efficiency, accuracy, and our heritage of "sea sense" on the bridge; these were the factors which, in darkness and storm, upset all the calculations of the enemy, and nullified all his efforts. The nerve of the Fleet was better, and the Fleet itself stronger, at the end of the winter than it had been at the beginning. The German calculation was that its nerve should have been gone, and the best of its ships destroyed. The strain only proved the quality of the Navy.

A "Tramp" Incident

There were many comparatively unimportant incidents of almost a year ago which at the time sent a grin round the fleet and did their part in the general hardening. These were connected, for the most part, with the attempts of the enemy to maintain supplies for his submarines. Many of our tars will recall one such incident which involved quite a feat of seamanship. It occurred out on the North Sea, and possibly a little west of the Long Forties. Just about twelve months have gone since the affair, but it still raises a smile in certain quarters. A fast, light cruiser of our Navy on a very dull morning, after a calm, cold night, sighted a cargo vessel under a neutral flag, and came to regard her with some suspicion. The "tramp" was kept under observation for a long time before she received any evidence at all of being watched. To outside appearance, the neutral was in that condition which brings to his mouth the heart of a skipper expectant of salvage, and no doubt more than one trawler that morning had glanced at her hopefully, and again and again, for a signal that she had broken down and wanted a tow.

Lying off in the distance, the warship was satisfied that the tramp was not "going lame," but was waiting for something. Having arrived at that conclusion, the neutral was approached in

the usual way, and an examination was made. In the making of the examination the "gullible and unsuspecting" Britisher rather scored. The officer entrusted with that duty did not spend much time over it. That was not necessary. He was apparently satisfied as to the bona fides of the tramp when he shouted a cheery "Good-bye," and returned to his ship. His report was to the point. Whilst "looking at nothing" he had seen enough to be certain that the vessel was neither a neutral nor an innocent tramp steamer with a defect in the engine-room. The warship disappeared, and the tramp "limped" along, with no more than steerage-way on, as before. Throughout eleven weary hours patient eyes and ready guns were turned on that unsuspecting merchantman, and at length darkness fell. Then there was vouchsafed the watchers that for which they had waited so long—the combination of lights on the neutral. It was a clever combination, in which her ordinary lights played the part of permanent basis. Having learned all that she seemed likely to learn by waiting, and being now certain that anything that was about to happen to the cargo steamer would not be seen by any submarines that might be about, the warship made a move in the darkness. During the whole eleven hours the position of the suspect had hardly changed. The extra lights of the combination suddenly vanished on the tramp as the cruiser bore nearer, and that was the first indication to the invisible fighting ship that the crew of the tramp had heard the rumble of machinery somewhere and were taking precautions. Then an astounding thing happened. On the quarter of the tramp a section of the darkness materialized in the most startling fashion, and from it there poured over the merchant ship a crowd of sturdy fellows who dashed for the bridge and dived for the engine room and had the ship in their hands and her crew prisoners within five minutes. The cruiser, slipping up in the blackness had laid her long, slim bows alongside as sweetly as ever she laid them along a jetty, and the boarding party asembled forward did the rest. The crew of the tramp had no time to do anything in the way of warning anyone. It was smart work, and a valuable capture. Stores of food, drums of oil fuel, and spare torpedoes were carried under the sham cargo of the supply ship. She was steamed into port by her prize crew, and she steamed very well indeed. It is said that she steamed out of port again not long after, and that on resuming her interrupted duties with a new crew she exercised a distinctly demoralizing influence upon certain units of the submarine service of the enemy.

Beatty's "Boarding"

The feat at seamanship involved in laying the cruiser alongside her quarry so suddenly and so closely in the darkness was noteworthy, but on the occasion of the fight at racing speed between our battle cruisers and those of the enemy, off the Dogger Bank, last January, there was provided a no less notable example of the splendid skill with which the fighting ships are controlled. It will be remembered that when the Lion dropped out of action, Admiral Beatty transferred his flag to the Princess Royal. The Princess Royal, steaming at full power, was using her guns with effect upon the fleeing enemy, without intermission. To recall her from that work in order that the Admiral might get on board was apparently not thought of. She had to be overtaken, not recalled. To catch her the Admiral boarded the Attack. The destroyer was asked to overtake a battle cruiser which was running at well over 30 miles per hour and to put the Admiral on board without delay. The Attack was "opened out" to the task, and it may be questioned if even her designers dreamt of the speed she developed. The Princess Royal was overhauled, but kept on her furious way, her guns crashing out unceasingly. Steadily the Attack worked closer, and very soon, with engine-room responding with marvellous precision to the demands of the bridge, she was reduced in speed to enable her absolutely to cling to the speeding leviathan ahead of her, and with both vessels rushing along at that terrific pace the Admiral passed from the destroyer to the battle cruiser and resumed his place in the action.

GUNMETAL: ITS COMPOSITION AND APPLICATIONS

THE following is a short summary of an article recently published in the "Foundry Trades' Journal":

The compositions which come under the heading of gunmetal include chiefly the following:

Copper	Tin	Zinc
88	11	2
88	11	1
87	8	5
87.5	6.25	6.25
84	12	4

The first of these is the recognized Admiralty steam metal, the second is used for general admiralty work, the third is for propellers, the fourth for bolts, and the fifth is a well-known metal for bearings. In making gun-metal, the copper should be melted first at a fairly rapid rate in a good fire, a cover of broken glass or powdered charcoal being used to protect from the atmosphere or from furnace fumes. When the metal is molten, the tin should be added, and finally, just prior to pouring, the zinc, the temperature then being raised slightly to overcome the chilling effects of the addition. A small piece of phosphor-copper used as a deoxidiser adds fluidity and aids soundness. The great essential in Admiralty specifications is purity of raw materials; the copper used should not contain more than 0.25 per cent. of arsenic, nor the zinc more than 0.25 per cent. of lead. Care must be taken not to overheat the metal in the furnace, nor to keep it at full heat for any longer time than is necessary: the molds must be ready when the metal is ready. The maximum temperature of pouring may be taken as 1,300 deg. Cent., and the aim should be to bring out the metal at this heat in order that it may enter the mold at not less that 1,100 deg. Cent. The rate of pouring should be more rapid than with iron; in fact, the metal should be poured as rapidly and fully as possible. Gun-metal being a somewhat sluggish metal, it is well to flush the mold by pouring extra metal through to clears away any gases which are liable to be entrapped.

The molds may be either green-sand or dry-sand. Much small work can be cast in green-sand, but if difficulty is experienced with blow-holes, it is advisable to dry the molds, and this is frequently done in larger work, as the trouble may be due to gases created in the molding blowing through the metal to escape. These gases are, of course, practically removed during the drying process, and there is only the contained air in the mold to be attended to. An open-grained sand usually obviates this trouble. Holes due to the liberation of dissolved gases are only dealt with by more careful melting or by changing the copper for a purer brand. In order to allow rapid pouring, the gates should be ample. Parts to be machined should be cast down; as any oxide present works to the top. The sand used in moulding should be of open texture and drier than is used for iron. The molds should be well rammed and well vented.

TO MAKE a permanent cement used for stopping leaks in steam pipes, where caulking or plugging is impossible, mix black oxide of manganese and raw linseed oil, using enough oil with the manganese to bring it to a thick paste; apply to the pipe or joint at leak. It is best to remove pressure from the pipe and keep it sufficiently warm to absorb the oil from the manganese. In twenty-four hours the cement will be as hard as the iron pipe.—Locomotive Engineering.

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Machine, Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

TRANSFER TRUCKS

IN order to meet the demand for a thoroughly efficient transfer truck of low cost, the George P. Clark Co., Windsor Locks, Conn., have placed on the market the two models illustrated.

FIG 1. TYPE WN30 TRUCK FRAME DEPRESSED

Type WN30 shown in Figs. 1 and 2 is adapted for loads from 500 to 1,000 lbs. The frame is made of channel steel, is designed to raise 1⅞ in., and is fitted with

FIG 3. TYPE YN10 TRUCK FRAME DEPRESSED

three wheels 6 in. diameter by 2 in. face having roller bearings and steel axles.

Fig. 1 shows the truck with the top frame in its lowest position with the lifting link resting on the front rod ready to elevate the frame. When the handle is pulled forward the top frame is swung upwards on the supporting links to its maximum elevation, when the lifting link can be unhooked from the rod by pressure of the operator's foot on the front end of the link which projects forward of the handle.

The platform which straddles the frame in the usual manner may now be transported to its destination and lowered by reversing the operations. This type is made in two sizes each having a capacity of 1,000 lbs., and taking a maximum size platform of 32 x 32 inches, and 42 x 32 inches respectively. These trucks weigh 130 lbs. and 140 lbs., the minimum height from floor to top of frame being 6 inches in both sizes.

A heavier type of truck for maximum loads of 2,200 lbs. is shown in Figs. 3 and 4. These are of substantial construction being built of malleable iron and steel, and of such proportions as will insure rigidity in use. The axles are of steel, the iron wheels 6 in. x 2 in. with dust proof roller bearings, and hardened and ground rolls and sleeves.

The elevating gear consists of combination cam-gears, the necessary movement being obtained by means of an anti-friction rack connected to the neap swivel and operated by the handle of the truck. The rack in the neap swivel moves only when the handle is swung away from the anti-friction roll, consequently the neap swivel can be turned completely around, which is of advantage when it is desired to move the truck with frame depressed.

The combination cam-gears provide a rolling lift which reduces lifting stress to a minimum. When elevated, the upper frame is positively locked in position by the sliding bolts, either of which is sufficient to hold the load elevated, while they cannot be disengaged except by raising the handle and again lowering it. All work of elevating or moving the truck is performed by the handle which is rigidly pivoted to the neap swivel.

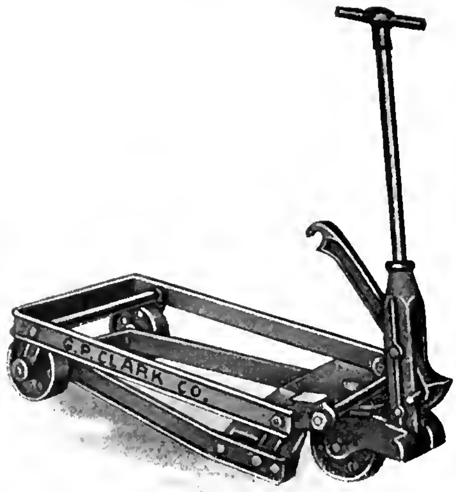


FIG. 2. FRAME ELEVATED

This truck type YN10 is built in four sizes, all having a minimum height of 6 inches with a lift of 2 inches. The maximum platform sizes vary from 32 x 32 inches to 52 x 38 inches, and the weights from 225 to 275 lbs. respectively.

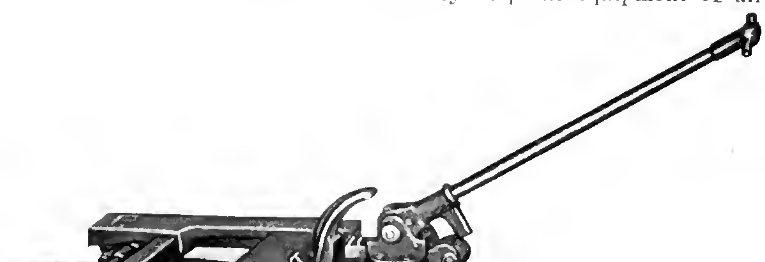
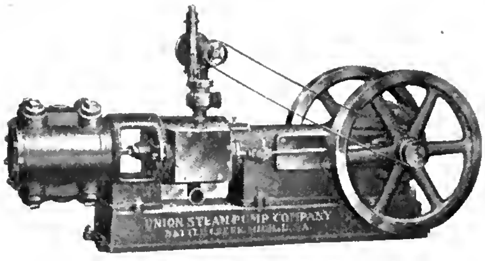


FIG. 4. FRAME ELEVATED

ENCLOSED AIR COMPRESSORS

THE constant demand for increased efficiency in plant equipment of all kinds has been met with corresponding effort on the part of builders. Air compressors are one line of manufacture which has been the object of consistent effort.

Creek, Mich., build a full line of compressors which embody all that is desirable in modern air compressor design. These machines are of both vertical and horizontal types, and are adaptable to

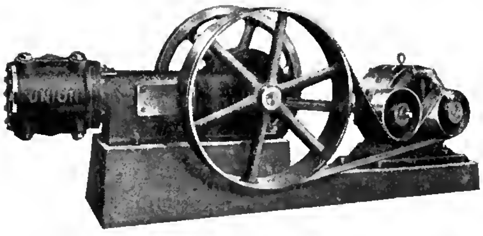


STEAM DRIVEN FLYWHEEL COMPRESSOR

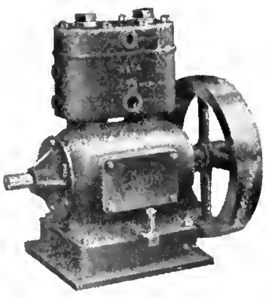
all drives. They are built with open frames as well as enclosed, and also duplex single-stage, and two-stage.

Enclosed construction, as shown in the illustrations, completely protects all running parts from grit or dirt, and enables the splash system of lubrication to be adopted. Access to the various parts is obtained through suitably placed cover plates.

Air valve design has received all the attention which this important feature


COMPRESSOR WITH MOTOR BELT DRIVE

deserves, and the flat steel-disc valve as developed by the makers is the result of many years' experience. This valve has a very small lift accompanied by freedom from noise, and its period of service is


VERTICAL DUPLEX COMPRESSOR

indefinitely lengthened by the use of special heat-treated steel in its construction.

In addition to the types illustrated, there is also manufactured a line of single cylinder vertical compressors from 3 x 3 inch to 6 x 6 inch, all of the water cool type.

SHRAPNEL SAND BLASTING MACHINE

SAND blasting shrapnel shells so as to thoroughly clean them externally and internally has found considerable favor. The apparatus here illustrated and described is a product of the W. W. Sly Mfg. Co., Cleveland, Ohio. The table of this machine has six shell pockets. Three of these are in the blasting department, and the other three as shown in the illustration are in the open. Thus, while three of the shells are being cleaned, the operator can remove the other three that have been cleaned, replacing them with three more to be blasted. Constant operation is thereby attainable.

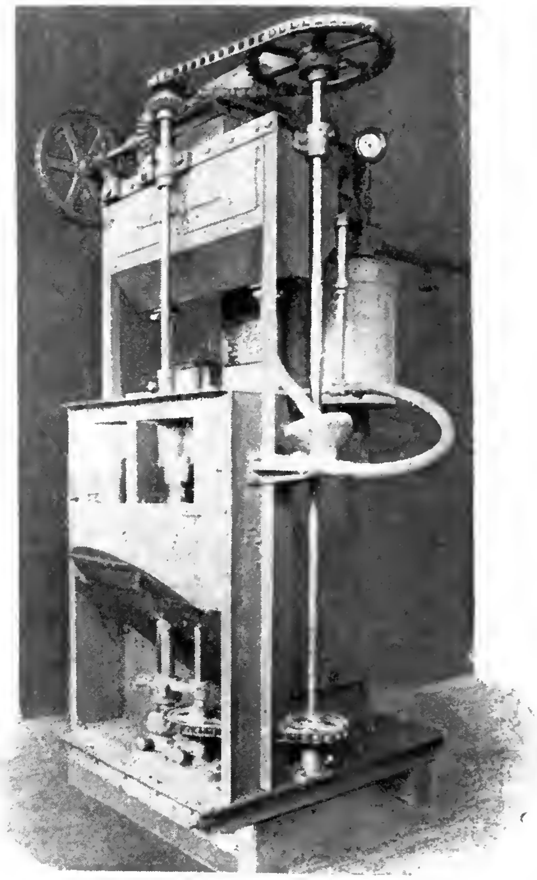
The apparatus when connected to an exhaust system is claimed to be nearly dustless and absolutely automatic in operation. All sand used falls into an elevator boot and is elevated by means of buckets into a storage hopper, from whence it is returned by gravity to the three nozzles shown. The sand is in this way used over and over again, until it becomes so fine that it is practically useless for its purpose.

All parts of the machine which are subject to wear are enclosed with sheet iron, and not exposed to the sand blast. On the sand blasting table proper it will be noted that the division plates are lined with wood to protect the steel plate. The wood is inexpensive and easily replaced. The only parts which are subject to wear are the nozzles, which may be replaced at a slight expense.

Each nozzle is provided with an air nozzle which is not subject to wear, and has a constant opening so that the air consumption does not increase during operation. The standard air nozzle has a 1/4 in. opening, which can be increased or decreased to suit conditions and the amount of air available.

The machine is designed so that the copper band groove and the upper part of the exterior of the shell are blasted by separate nozzles. When necessary to blast a small portion of the interior of the shell, the apparatus can be arranged to do so. Its capacity for continuous running is from 150 to 200 shells per hour.

The speed of working and the peculiarly clean surface obtained by means of sand blasting, combined with the absence of danger, due to scalding when using wash tanks, etc., commend this machine to all shell manufacturers who aim at producing the best quality of work with the least possible amount of rejections.


SHRAPNEL SAND BLASTING MACHINE.

DURANT COUNTING MACHINES

AS the result of a regrettable error, the description appearing October 21st of the new model counting machine made by the Durant Manufacturing Company, of Milwaukee, Wis., was accompanied by an illustration of an entirely different article. The discrepancy, while sufficiently obvious to our readers, is

MODEL "D" DURANT COUNTER

inexcusable, and in reproducing the correct illustration of the Durant Model "D" Counter, we tender our apologies to both the Durant Company and the makers of the article, which was inadvertently illustrated.

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SHELL COMMITTEE RECONSTITUTION

SHELL manufacture in Canada having passed beyond the "immediate emergency" stage, it naturally followed, if the efforts of our metal-working plants continued to be requisitioned, that something more akin to a commercial basis for the distribution of future contracts would be developed and established. Recent happenings indicate progress in such a direction.

We are not of those who seem to see an investigation of the Shell Committee work looming up, and much less still would we expect to find, as a result, a series of unsavoury revelations. The organization of a Shell Committee for Canada was beset with difficulties relative to its personnel that many of its detractors neither appreciate nor want to.

The emergency of the situation a year ago made it altogether impossible for either official British expert knowledge or that of her Allies to be available. Assistance from the United States could not be considered on account of that country's neutrality. We were therefore put upon our own resources, if we would undertake the work. It was also fully realized that we were placed in the gracious position of aiding materially in our Empire struggle, and incidentally of helping ourselves.

The personnel of the Shell Committee had of necessity to consist of both a civil and a military element, and as regards the former—the most severely criticized, it would have been utter folly to have attempted to exclude such of our prominent manufacturers or their representatives who found a seat in its councils.

The Shell Committee appreciating the responsibility laid upon them, took no chances, of course, in placing contracts. Shell orders, even small as they were at first, did not come to us simply to give opportunity to experiment. Shell shipments were urgently required and shipping dates might be stated to have been the very essence of every contract.

Like every other big issue to be met—the "Message to Garcia," or "Shells to Britain," the men on whom the onus was laid took it as a personal matter, and staked their manufacturing reputations on the enterprise. They let contracts at the start-off to just such firms as their personal knowledge and experience warranted. It is therefore assuming nothing, much less making endeavor to mitigate what spiteful criticism dubs an indiscretion, when we say that manufacturers' representatives on the Shell Committee, were in every sense justified in sharing the bulk of the initial contracts among the firms in which they were interested.

Regarding prices paid for shells in Canada, much ill-advised criticism is being directed against the Shell Committee. A substantial price was in the earlier stages paid for the work; this has not, however, been maintained. It was but reasonable that a good margin should be provided our machine shops, not only to allow them to install the necessary equipment, but to make haste slowly towards success.

D. A. Thomas has been here to find out just what stage of productivity we have reached; to find out if we have taken advantage of the good margin price to install and equip, or to find out if we have simply temporized. He has got all data of that nature together, and the No. 1 firms—large and small are going to participate soon in the distribution of larger than ever shell orders and larger than ever shells. The best answer to all requests for a commission of investigation and the best opiate for the friction gossip is that D. A. Thomas has seen to the former and is satisfied, and that the latter in consequence does not exist.

The Shell Committee is being reconstituted, because Britain is now in a position to spare men with expert knowledge to co-operate with us in the work. Further, some of our manufacturing representatives are only too glad to again get opportunity to give their whole attention to the particular enterprises with which they are connected. The association of Brig.-Gen. Bertram and Lt.-Col. D. Carnegie, at least, with Lionel Hichen and R. H. Brand as the administrative board of the new Shell Committee, will express publicly Mr. Thomas' appreciation of the sincerity of purpose with which the civil section of the old committee carried out its work, and at the same time commend the high-degree achievement which it realized.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

	Montreal.	Toronto
Grey forge, Pittsburgh		$14 70
Lake Superior, charcoal, Chicago		15 75
Ferro Nickel pig iron (Soo)		25 00
Middlesboro, No. 3	$24 00	.....
Carron, special	25 00	.....
Carron, soft	25 00	.....
Cleveland, No. 3	24 00	.....
Clarence, No. 3	24 50	.....
Glengarnock	28 00	.....
Summerlee, No. 1	30 00	.....
Summerlee, No. 3	29 00	.....
Michigan charcoal iron	28 00	.....
Victoria, No. 1	24 00	21 00
Victoria, No. 2X	23 00	21 00
Victoria, No. 2 plain	23 00	21 00
Hamilton, No. 1	23 00	21 00
Hamilton, No. 2	23 00	21 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	2.35
Steel bars, f.o.b., Toronto	2.35
Common bar iron, f.o.b., Montreal	2.35
Steel bars, f.o.b., Montreal	2.35
Twisted reinforcing bars	2.35
Bessemer rails, heavy, at mill	1.25
Steel bars, Pittsburgh	1.50
Tank plates, Pittsburgh	1.50
Beams and angles, Pittsburgh	1.50
Steel hoops, Pittsburgh	1.60
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.40
Small shapes	2.65
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	2.25
Structural shapes	2.50
Plates	2.30

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ¼ to ½ in., 100 lb.	$2 25	$2 25
Heads, per 100 lb.	2 50	2 45
Tank plates, 3-16 in.	2 60	2 45

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$12 25	$12 25
Copper, crucible	14 25	14 00
Copper, unch-bled. heavy	14 25	13 50
Copper, wire, unch-bled.	14 25	14 00
No. 1 machine compos'n	11 50	11 50
No. 1 compos'n turnings	10 25	10 00
No. 1 wrought iron	10 00	9 50
Heavy melting steel	8 50	9 50
No. 1 machin'y cast iron	13 50	12 00
New brass clippings	11 00	11 00
No. 1 brass turnings	9 00	9 00
Heavy lead	4 60	4 50
Tea lead	$ 3 50	$ 3 50
Scrap zinc	10 50	9 50

W. I. PIPE DISCOUNTS.

Following are Toronto jobbers' discounts on pipe in effect Aug. 27, 1915:

	Buttweld Black	Gal.	Lapweld Black	Gal.
Standard				
¼, ⅜ in.	63	38½	....	....
½ in.	68	47½	....	....
¾ to 1½ in.	73	52½	....	....
2 in	73	52½	69	48½
2½ to 4 in	73	52½	72	51½
4½, 5, 6 in.	....	....	70	49½
7, 8, 10 in.	....	....	67	44½
X Strong P. E.				
¼, ⅜ in.	56	38½	....	....
½ in.	63	45½	....	....
¾ to 1½ in.	67	49½	....	....
2, 2½, 3 in.	68	50½	....	....
2 in.	....	....	63	45½
2½ to 4 in.	....	....	63	48½
4½, 5, 6 in.	....	....	66	48½
7, 8 in.	....	....	59	39½
XX Strong P. E.				
½ to 2 in.	44	26½	....	....
2½ to 6 in.	....	....	43	25½
7 to 8 in.	....	....	40	20½
Genuine Wrot Iron.				
⅜ in.	57	32½	....	....
½ in.	62	41½	....	....
¾ to 1½ in.	67	46½	....	....
2 in.	67	46½	63	42½
2½, 3 in.	67	46½	66	45½
3½, 4 in.	....	....	66	45½
4½, 5, 6 in.	....	....	63	42½
7, 8 in.	....	....	60	37½

Wrought Nipples.	
4 in. and under	77½%
4½ in. and larger	72½%
4 in. and under, running thread	57½%
Standard Couplings.	
4 in. and under	60%
4½ in. and larger	40%

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	60 & 10%
Sq. Head Set Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45%
Flat & But. Head Cap Screws	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in. N.	70%
Semi-Fin. Nuts up to 1 in.	70%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

METALS.

	Montreal.	Toronto.
Lake copper, carload	$20 00	$19 50
Electrolytic copper	20 00	19 25
Castings, copper	19 25	19 00
Tin	38 00	39 00
Spelter	18 00	17 50
Lead	6 50	6 25
Antimony	35 00	35 00
Aluminum	60 00	60 00

Prices per 100 lbs.

BILLETS.

	Per Gross Ton
Bessemer ,billets, Pittsburgh	$25 00
Openhearth billets, Pittsburgh	26 00
Forging billets, Pittsburgh	40 00
Wire rods, Pittsburgh	32 00

NAILS AND SPIKES.

Standard steel wire nails, base	$2 60	$2 55
Cut nails	2 50	2 70
Miscellaneous wire nails	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	70-10
Stove bolts	80
Plate washers	40
Machine bolts, ⅜ and less	65-10
Machine bolts, 7-16 and over	57½
Blank bolts	57½
Bolt ends	57½
Machine screws, iron, brass	—35
Nuts, square, all sizes	4c per lb. off
Nuts, hexagon, all sizes	4½c per lb. off
Iron rivets	72½
Boiler rivets, base, ¾-in. and larger	$3.75
Structural rivets, as above	3.75
Wood screws, flathead, bright	85, 10, 7½, 10 p.c. off
Wood screws, flathead, Brass	75 p.c. off
Wood screws, flathead, Bronze	70 p.c. off

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong, Sizes Ins.	Price per ft.	D. Ex. Strong. Size Ins.	Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.....
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....

COKE AND COAL.

Solvay Foundry Coke	$6.25
Connellsville Foundry Coke	5.65
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

COLD DRAWN STEEL SHAFTING.

At mill	30%
At warehouse	35%

Discounts off new list. Warehouse price at Montreal and Toronto.

MISCELLANEOUS.

Solder, half-and-half	0.23
Putty, 100-lb. drums	2.70
Red dry lead, 100-lb. kegs, per cwt.	9.65
Glue, French medal, per lb.	0.15
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.20
Benzine, single bbls., per gal.	0.21½
Pure turpentine, single bbls.	0.80
Linseed oil, raw, single bbls.	0.77
Linseed oil, boiled, single bbls.	0.80
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.25
Lead Wool, per lb.	0.11
Pure Manila rope	0.16
Transmission rope, Manila	0.20
Drilling cables, Manila	0.17
Lard oil, per gal.	0.73
Union thread cutting oil	0.60
Imperial quenching oil	0.35

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto 40%

PROOF COIL CHAIN.

¼ in.	$9.00
5-16 in.	5.90
⅜ in.	4.95
7-16 in.	4.65
½ in.	4.40
9-16 in.	4.05
⅝ in.	4.30
¾ in.	4.15
⅞ inch	3.65
1 inch	3.45

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	55
Carbon over 1½ in.	25
High Speed	
Blacksmith	55
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Centre	25
Pipe Reamers	80

Discounts off standard list.

IRON PIPE FITTINGS.

Canadian malleable, A, 25 per cent.; B and C, 35 per cent.; cast iron, 60; standard bushings, 60 per cent.; headers, 60; flanged unions, 60; malleable bushings, 60; nipples, 75; malleable, lipped unions, 65.

TAPES.

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3.50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$3 00	$2 85
Canada plates, dull, 52 sheets	3 15	3 15
Canada Plates, all bright	4 60	4 75
Apollo brand, 10¾ oz. galvanized	5 50	4 80
Queen's Head, 28 B.W.G.	6 00	5 95
Fleur-de-Lis, 28 B. W. G.	5 75	5 75
Gorbal's Best, No. 28	6 00	6 00
Viking metal, No. 28	5 25	5 25
Colborne Crown, No. 28	5 70	5 80
Premier No. 28	5 10	5 00

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$14 25	....
1¼ in.	14 25	....
1½ in.	14 25	....
1¾ in.	14 25	....
2 in.	14 25	9 25
2¼ in.	15 50	10 50
2½ in.	16 50	11 50
3 in.	21 00	12 25
3½ in.	24 00	14 50
4 in.	29 50	18 50

Prices per 100 feet, Montreal and Toronto.

WASTE.

WHITE.	Cents per lb.
XXX Extra	0 11
X Grand	0 10½
XLCR	0 09¾
X Empire	0 09
X Press	0 08¼
COLORED.	
Lion	0 07½
Standard	0 06¾
Popular	0 06
Keen	0 05½
WOOL PACKING.	
Arrow	0 16
Axle	0 11
Anvil	0 08
Anchor	0 07
WASHED WIPERS.	
Select White	0 08½
Mixed Colored	0 06¼
Dark Colored	0 05¼

This list subject to trade discount for quantity.

BELTING RUBBER.

Standard	50%
Best grades	30%

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50%
Standard	50 & 10%
Cut leather lacing, No. 1	$1.20
Leather in sides	1.10

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	$9.50
¼ in.	6.55
5-16 in.	5.20
⅜ in.	4.25
7-16 in.	4.00
½ in.	4.00

Prices per 100 lbs.

PLATING CHEMICALS.

Acid, boracic	$ .15
Acid, hydrochloric	.05
Acid, hydrofluoric	.06
Acid, Nitric	.10
Acid, sulphuric	.05
Ammonia, aqua	.08
Ammonium carbonate	.15
Ammonium chloride	.11
Ammonium hydrosulphuret	.35
Ammonium sulphate	.07
Arsenic, white	.10
Copper sulphate	.10
Cobalt Sulphate	.50
Iron perchloride	.20
Lead acetate	.16
Nickel ammonium sulphate	.10
Nickel carbonate	.50
Nickel sulphate	.15
Potassium carbonate	.40
Potassium sulphide (substitute)	.20
Silver chloride (per oz.)	.65
Silver nitrate (per oz.)	.45
Sodium bisulphite	.10
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.35
Sodium hydrate	.04
Sodium hyposulphite (per 100 lbs.)	3.00
Sodium phosphate	.14
Tin chloride	.45
Zinc chloride	.20
Zinc sulphate	.08

Prices Per Lb., Unless Otherwise Stated.

ANODES.

Nickel	.47 to .52
Cobalt	1.75 to 2.00
Copper	.22 to .25
Tin	.45 to .50
Silver	.55 to .60
Zinc	.22 to .25

Prices Per Lb.

PLATING SUPPLIES.

Polishing wheels, felt	1.50 to 1.75
Polishing wheels, bullneck	.80
Emery in kegs	.4½ to .06
Pumice, ground	.05
Emery glue	.15 to .20
Tripoli composition	.04 to .06
Crocus composition	.04 to .06
Emery composition	.05 to .07
Rouge, silver	.25 to .50
Rouge, nickel and brass	.15 to .25

Prices Per Lb.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., Nov. 1, 1915—Conditions generally in the steel and metal markets show some improvement over last week. Quotations on many products have been advanced and are very firm. The shell industry continues to develop and the heavy demand for steel for munitions is keeping the mills operating at capacity. Indications point to a considerable increase in tonnage.

Preliminary investigations are being made with a view to establishing an ordnance factory at some central point. Sir Frederick Donaldson and General Mahon have been visiting several mills and shops with the object of ascertaining if these plants can be utilized for making parts of guns. A large number of tenders have been received for the new eighty-million dollar shell order, and contracts will likely be distributed during the present week. With the reorganization of the Shell Committee, the production of shells will be stimulated.

Steel Market

The steel industry is still taxed to the utmost trying to meet the continued demand for bars and billets. Orders for 6-in., 8-in. and 9.2-inch shells are expected to be placed this week and this will call for production of a larger tonnage of billets for the forging of these shells. Some progress has already been made by a few of the larger plants on the forgings for these shells, and it is expected that little delay will be experienced in making the necessary preparation for the machining operations.

Machine Tools and Supplies

Little change is noted in the machine tool situation. The delay in delivery is one of the chief drawbacks to the shell makers. Delivery at a specified date is very uncertain, and with the increased demand for tools, caused by the placing of new orders for shells, is expected to complicate rather than relieve the situation.

The prospect of a demand for heavy tools, suitable for the manufacture of heavy projectiles of the 6-in., 8-in. and 9.2-inch type, will open a new field for the tool builder.

Sheets

The present indications show a tendency to higher quotations on dull and bright sheets, which may go into effect at any time. Demand for black sheets for early delivery has increased somewhat and the demand for galvanized sheets has also improved. Large enquiries are being made for blue annealed sheets. An advance in sheets is expected shortly.

Metals

Quotations on the various metals show little change over that of a week ago, with the exception of tin and lead, both of which have advanced. Rumors of a heavy demand for copper from Europe for war purposes is causing producers to anticipate an advance in price. Quotations are unchanged this week.

The increase in tin appears to be caused by the apparent scarcity of this metal, which is, by general indications, somewhat exaggerated. Little improvement is noted in the consumption and no change in the visible supply.

Spelter at present is steady, but may advance before the close of the week.

CANADIAN GOVERNMENT PURCHASING COMMISSION

The following gentlemen constitute the Commission appointed to make all purchases under the Dominion $100,000,000 war appropriation:—George F. Galt, Winnipeg; Hormidas Laporte, Montreal; A. E. Kemp, Toronto. Thomas Hilliard is secretary, and the commission headquarters are at Ottawa.

Lead has shown a small increase within the last few days, but the general market is little changed from a week ago.

Old Materials

The prices on scrap metals are holding firm; slight advances are noted, with prospects of further increases shortly.

Toronto, Ont., Nov. 2.—The industrial situation continues to improve, and the marked increase in production is shown by the development in the export trade. Exports already far exceed in value the imports for corresponding periods, and there is every indication that this tendency will continue for several months. As a result of the war, Canadian manufacturers are producing many articles which were previously imported. This should prove a permanent benefit to the country and increase the number of industries in Canada. In addition, outputs have considerably increased in products which have been manufactured in Canada for some years, thus assisting materially in consolidating the position of the industries affected. The value of orders for articles purely for war purposes has already reached a large total and will increase considerably. The Dominion Customs revenues for the month of October increased by two and one-half million dollars over the corresponding month last year, and in the seven months of the fiscal year the increase was nearly fifty-three million dollars.

The reorganization of the Shell Committee is proceeding quietly, and will probably be completed very shortly. The prospective development in the shell industry and extension of the powers of the committee render this step desirable. The committee in future will to all intents and purposes be directly responsible to the British Minister of Munitions. Tenders for 6 in., 8 in., and 9.2 in. high explosive howitzer shells have been submitted by several firms, and contracts will be awarded at an early date. The possibility of establishing an ordnance industry in Canada is under consideration. Experts are engaged in obtaining the necessary data as to the firms which might be able to manufacture parts of guns to be assembled later in a large central plant under Government supervision.

Steel Market

Extraordinary activity prevails in the steel market and the demand for steel for munitions continues to increase. The production of steel rounds has reached a heavy tonnage and mills have all the business they can handle. The Algoma Steel Co. is the latest concern to take up this class of work, they having secured an order through J. P. Morgan & Co. for 30,000 tons of rounds, while other contracts involving 20,000 tons of rounds have been closed. The contracts for the larger calibre shells, which will be placed shortly, will call for a considerable increased production of steel.

Conditions in the galvanized sheet trade are still somewhat unsettled. Owing to the increase in the price of black sheets and the possibility of higher prices for spelter, galvanized sheets have an upward tendency, although there is no change in prices to be noted this week. Black sheets are strong, No. 28 gauge being firmly held at $2.10 Pittsburg basis for early delivery, and mills are refusing to sell for extended shipments.

The steel trade in the States is in a very satisfactory condition. There is no abatement in the demand for various lines of steel, which is in excess of the producing capacity of the mills. Makers are still unable to meet the heavy demand for large rounds for shells, and the mill capacity is sold up months ahead. In addition to steel rounds, there is a good export demand for barb wire, forging billets, blooms and wire rods. The continued heavy demand for billets is forcing prices upward. Bessemers billets are now quoted at $25, open-

hearth billets $26, and forging billets $40 base f.o.b. Pittsburg.

Pig Iron

The situation in the pig iron trade is improving, and prices are holding firm. The consumption of low phosphorous iron is increasing, and there is also a better demand for foundry iron.

Old Material

The market is quiet, but prices are firm. There is not much demand for old metals except heavy melting steel, which is strong. Prices on scrap copper are unchanged, and there is a fair demand.

Machine Tools

Great interest is being manifested in the machine tool trade over the contract for the larger calibre shells, which will be awarded shortly. These shells are 6 in., 8 in. and 9.2 in., and weigh 180, 250 and 290 lbs. filled, respectively. Heavier tools will, therefore, be required than are being used for the 18-pdr. Lathes with 24 in. and 30 in. swing will be in good demand, although considerable difficulty may be experienced in getting delivery this year on new equipment. Quicker delivery is obtainable on second-hand lathes, and the market for this class of equipment will be stimulated. It is reported that some contracts for the large shells have already been placed, but no official statement has been issued as yet.

Supplies

Business continues active in machine shop supplies, and prices are very firm. The lines in greatest demand consist of chucks, taps and dies, drills, belting and belt fasteners, cutting compounds, etc. Prices of high-speed twist drills are still withdrawn, and quotations are subject to immediate acceptance. The high-speed tool steel situation is unchanged, stocks are very low and prices continue to advance. A sharp advance of 10c is to be noted in turpentine, due, it is said, to a shortage of supplies at Savannah. Turpentine is being quoted in Toronto at 80c per Imperial gallon. Prices of solders have advanced ½c, due to the strength in the tin market. Quotations on benzine have been adjusted; the new price is 21½c per gallon in barrels.

Metals

The market is holding steady, and, with the exception of an advance in tin, there are no price changes to note. The copper market is still very quiet, and the buying movement has not started, although it is anticipated that there will be one shortly. Spelter is higher in London, but unchanged locally. Lead is stronger, and will possibly advance. The antimony situation is unchanged, and prices are holding firm. There is a continued scarcity of aluminum, and supplies of this metal are almost unobtainable. The situation in the metal market locally is unchanged, and trade reports show business as being brisk in metals for munitions.

Tin.—A more active demand for spot and near-by tin has had a favorable effect on the market. There is, however, no improvement in actual consumption and so change in the visible supply. It is doubtful, therefore, if the advance is justified by conditions. Tin has advanced 2c, and is now quoted at 39c per pound.

Copper.—There is no change in the situation; the market is quiet, and there is little business doing. It is reported that producers are in control of the market—which indicates a possibility of higher prices. Local quotations are firm and unchanged at 19½c per pound.

Spelter.—The London market has advanced, but it has not affected New York except to make that market firmer. The market is uncertain, and consumers are inclined to defer buying, except those making munitions, until the situation clears up. There is every possibility that the demand for spelter for galvanizing will increase, as the substitutes which have been tried have not proved a success, and there is also a possibility of the demand for sheets increasing. Local prices of spelter are unchanged and firm at 17½c per pound.

Lead.—The "Trust" have advanced the price of lead $3 per ton to a basis of $4.90 New York. Local prices, however, are unchanged meanwhile. There is a continued big demand for lead, and the position is a strong one. Local quotations are very firm at 6¼c per pound.

Antimony.—There is no improvement to be recorded in the market for antimony, which is under the control, for all practical purposes, of the British Government. There is a tremendous demand for this metal, and English makers have practically ceased to export any except to the Dominions, and then only for munitions. Quotations are firm and unchanged at 35c per pound.

Aluminum.—The market is very firm, and has an upward tendency. There is a big demand for aluminum, but it is very scarce and difficult to obtain. Local quotations are entirely nominal at 60c per pound.

ALLIES PURCHASING AGENTS

The Trade and Commerce Department, Ottawa, has published the following list of purchasing agents for military purposes for the allied Governments:

International Purchasing Commission, India House, Kingsway, London, Eng.

French.—Hudson Bay Co., 56 McGill Street, Montreal; Captain Lafoulloux, Hotel Brevort, New York; Direction de l'Intendence Ministere de la Guerre, Bordeaux, France; M. De la Chaume, 28 Broadway, Westminster, London.

Russian.—Messrs. S. Ruperti and Alexsieff, care Military Attache, Russian Embassy, Washington, D.C.

CANADIAN TRADE RETURNS

THE total Canadian trade for the six months of the fiscal year ending September 30 last was well over half a billion dollars, according to the official statement issued by the Hon. J. D. Reid, Minister of Customs. The figures show a very satisfactory advance over the corresponding six months of 1914, which were $500,634,000, as against $559,529,000 for the six months just ended, or in round figures a total increase of trade of 59 millions of dollars.

The trade for September just ended was as follows: Merchandise entered for consumption, $38,026,000; domestic exports, $46,129,000, or a total of $84,156,000. This is a considerable advance on September, 1914, when the imports were $36,567,000, and the domestic exports $31,796,000, or a total of $68,364,000.

The export of manufactured goods for September was very heavy—reaching a total of $9,244,000, compared with $5,188,000 for September, 1914. Of agricultural products, $11,139,000 worth were exported last September, as against $7,478,000 for the corresponding month last year. The export of domestic animals and their produce was also heavy—being $10,188,000, against $7,063,000 for September, 1914.

It is interesting to note there is a substantial increase in the export of domestic fisheries for the month of September, the total being $2,750,000, against $1,900,000 for September, 1914.

The importation of free goods for September last was $15,746,000, compared with $13,991,000 for September, 1914. For the six months ending September last Canada imported of free and dutiable goods, $213,588,000. During the same period she exported $246,392,000, so that our value of exports were considerably greater than our imports.

On the whole, the showing is a very satisfactory one, the duty collected for the six months just ended being $44,418,000, compared with $42,857,000 for the corresponding period of 1914.

WAR BENEFITS CANADIAN TRADE

JUDGING by detailed trade figures published by the Department of Trade and Commerce, the war is having a good, rather than an injurious effect upon Canadian trade. For the six months ending with September of this year, Canada's total trade in merchandise was $486,966,000, or $18,440,000 more than it was for the corresponding six months of last year, for the most part under antebellum conditions. While imports of merchandise during the past six months show a relative decrease of thirty-eight millions, exports of Canadian produce show an increase of sixty-five millions. Exports of foreign products, however, show a decrease of some ten millions.

Figures for the month of September show that even in imports there is now beginning to be an increase, compared with last year, and although the September increase of $1,459,000 may in part be attributed to the unsettled conditions of September last year, immediately following the outbreak of the war, it is believed that it reflects in large measure the definite turning of the tide, pointing to renewed business confidence, replenishment of stocks in Canada, and a steady up-grade tendency in regard to the country's ability to pay for its imports through the increased volume of its exports.

For September, exports totalled $46,129,000, an increase of $14,333,000 over September of last year. Of this increase four millions is credited to manufactures, three millions to animal produce, and five millions to agricultural produce. As for the balance of trade, it is interesting to note that the total exports for the past six months have been $246,000,000, as compared with total imports of $213,000,000.

The value of war orders to Canada in stimulating exports is seen especially in the figures in regard to manufactured exports. For the past six months the total value of manufactured articles exported has been $71,476,000, or $39,559,000 more than for the corresponding months of last year. The increase is more than 100 per cent.

For the full twelve months ending with September last, the aggregate trade in merchandise was $935,254,000, a decrease of $64,809,000 as compared with the preceding twelve months. Imports totalled $417,472,000, a decrease of $114,000,000, while exports of merchandise totalled $474,000,000, an increase of $40,000,000.

DOMINION REVENUE SHOWING INCREASE

THE Dominion revenues for the month of October so far indicate a further substantial increase and the monthly statement is expected to be a most satisfactory one. This evidence and others emphasize the growing strength of the financial position of Canada as a result of the special measures resorted to since the outbreak of the war. There is every probability that the revenue estimate given to Parliament by the Finance Minister in his last budget will be more than realized.

The restoration of a normal situation as regards exchange between the United States and Canada is also affecting beneficially the affairs of the Dominion. The flotation of the $45,000,000 Canadian loan in New York in August and the sale in New York of sterling bills drawn against shipments of Canadian wheat to Great Britain and Europe have brought exchange on New York back practically to par. This is a marked improvement over the situation of three months ago, when the American dollar was worth more than the Canadian dollar, and a premium of one-half to one per cent. in Canadian money had to be paid for funds in New York.

The loan, in addition to stabilizing exchange between Canada and the United States, helped sterling exchange also by providing Canada with funds which otherwise would have been obtained in London. In addition, it conserved the gold reserves of Canada and paved the way for the Anglo-French loan.

It is learned here that the proceeds of the loan were not brought to Canada at once, but were withdrawn gradually so as to gradually reduce the exchange. The Finance Department made over $36,000 in exchange in the transfer of the money.

RECORD OF COPPER PRODUCTION

IT IS announced from New York that the present output of copper by smelters as well as by refiners, is record-breaking, just as it is in steel; but the entire production of copper is not being taken up, as is the case with crude and rolled steel.

During September, it is conservatively estimated that there was a surplus of 30,000,000 pounds in producers' stock in this country. This is based upon an estimated total consumption of 125,000,000 pounds. As the exports were approximately 35,000,000 pounds, this would leave 90,000,000 pounds for domestic consumption. Estimates of melting by domestic consumers range from 80,000,000 to 100,000,000 pounds, but it is doubtful that there is capacity enough to consume 100,000,000 pounds per month, even with the recent extensions made to manufacturing plants.

The total production of blister copper in September is estimated at 165,000,000 pounds, but the refined output is said to have been 5,000,000 to 10,000,000 pounds less; thus it is indicated that there was an increase in smelters stocks of about 10,000,000 pounds, as well as an increase of 30,000,000 pounds in stocks at the refineries.

CANADA'S TRADE WITH GREAT BRITAIN

THE following are the official figures of trade between Great Britain and Canada in the undermentioned articles during September:

	Sept. 1915	Sept. 1914
Exports from Canada.	£	£
Wheat	956,572	2,213,733
Wheatmeal and flour	143,422	87,604
Barley	220,399	46,654
Oats	9,316	115,189
Bacon	250,916	137,955
Hams	21,313	99,815
Cheese	342,055	634,833
Canned salmon	85,069	36,699
Canned lobsters	27,063	43,823
Imports to Canada.		
Spirits	31,023	49,101
Wool	34,086	11,056
Pig iron	17,823	1,945
Wire	544	5,969
Galvanized sheets	6,780	5,898
Tinned plates	2,988	6,344
Steel bars	7,701	7,138
Pig lead	3,266	3,569
Cutlery	9,423	9,300
Hardware	1,790	5,742

PROMISING OPENINGS FOR CANADIAN TRADE

THE Export Association of Canada, acting under the auspices of the Canadian Government and the Canadian Manufacturers' Association, met in London, England, to inaugurate a co-operative movement to extend Canadian trade, especially in countries where German commercial influence has hitherto been predominant.

F. C. Armstrong, joint general manager, presided. The gathering included representatives of the Canadian Car & Foundry Co., the Dominion Bridge Co., the Canadian General Electric , the National Steel Co., the Dunlop Tire Co., the Northern Electric, the Canadian Rubber Co., the Dominion Steel Corporation, the National Steel Car Co., the C. P. R., the G. T. R., and the C. N. R.

The speeches indicated a most promising opening of Canadian trade with Russia, Serbia, Italy, France and other parts of Europe, and also Great Britain. There was a general agreement that Canadian manufacturers and merchants should profit by the example of the Germans, so successfully set before the war, by methods of close co-operation in national interests between producers and railways and steamship companies, to secure the lowest possible freights. An

executive committee was formed to organize a vigorous campaign.

CANADIAN TRADE WITH OUTSIDE COUNTRIES

COMPARATIVE figures of customs revenue contributed by the different provinces are furnished by the annual report of the Customs Department just issued and covering the last fiscal year. Ontario leads with $33,218,000 collected in duties, Quebec comes next with $22,919,000. The revenue from other provinces was as follows: British Columbia, $7,373,000; Manitoba, $6,413,000; Nova Scotia, $2,930,000; New Brunswick, $2,162,000; Alberta, $2,484,000; Saskatchewan, $1,356,000, and Prince Edward Island, $160,225.

Quebec takes first place in exports. In the fiscal year they totalled $181,982,000 compared with $167,685,000 for Ontario. New Brunswick is third on the list with $54,322,000.

Imports from Germany during the fiscal year 1913-14 aggregated $14,500,000. In the year ended March last they fell to $5,000,000. Goods from the United States show an increase, being $428,000,000 compared with $410,000,000 in the previous year. Imports from the United Kingdom declined from $132,000,000 to $90,000,000.

On the other hand, Canada exported to Great Britain $211,000,000 worth of goods and to the United States $215,000,000 worth. There is likewise an increase in exports to France which grew from three million in 1913-14 to fourteen millions in 1914-15.

A small trade was done with Spain. Exports to that country amounted to $489,000 and imports $977,000. Italy took two millions worth of goods from Canada last year and we imported $1,472,000 worth. Two million dollars of exports were sent to Germany in 1914 before war was declared and all trade suspended. To Australia our exports were five and a half millions, to the West Indies nearly six and a half millions and to Newfoundland $4,481,000.

Manufacture of Guns Contemplated—It is believed in Ottawa that the manufacture of heavy guns in Canada is practically assured as the result of the investigation made by Sir Frederick Donaldson and Gen. Mahon, but that the British experts are not disposed to encourage a venture on so large a scale as was contemplated at the conference of manufacturers and bankers in Ottawa a few weeks ago. When Sir Frederick Donaldson and Gen. Mahon have completed their enquiry, it is probable that an ordnance plant will be established on the basis of a stated order from the British Government. The Canadian Government will have the opportunity of taking over the plant at the close of the period if it so desires.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Hedley, B.C.—The Daly Reduction Co. have recently installed a number of new units at their plant.

Hespeler, Ont.—The A. B. Jardine Co. will enlarge their plant. A building 50 ft. x 60 ft. will join the machine shop and foundry.

Valleyfield, Que.—The town will loan the Castings Company of Canada $25,000. This is a new concern, which proposes making shells.

Collingwood, Ont.—There is a possibility of operations being started at the Northern Iron and Steel Works. G. Manton, of Cleveland, Ohio, is an interested party.

Sarnia, Ont.—The Sarnia Metal Products Co. has received from the British Government a war contract, which amounts to a large figure, for shell parts. New machinery to the value of $37,000 has been purchased.

Welland, Ont.—The Electro Steel Metals Co. will extend their plant. The extensions will include a machine shop, 30 ft. x 50 ft., and an office building, 40 ft. x 50 ft., two storeys high. A 6-ton electric furnace will be installed.

Woodstock, Ont.—J. D. Tindall & Son have been given the contract for the construction of an addition to William Baird's machine shop on Dundas street. The addition to be erected will be added to the present building and will be 60 ft. x 90 ft.

Montreal, Que.—The directors of the Laurentide Company have under consideration a large extension to their paper mill at Grand Mere, Que. It was stated that the output of the mill could be doubled by an expenditure of $1,500,000. Mr. Chahoon is president of the company.

Nelson, B.C.—Fred. R. Wolfle, president and general manager of the Florence Mine, states that construction work will start soon on a 200-ton daily capacity concentrator, a hydro-electric power station and compressor plant, together with extensive underground development to cost not less than $150,000.

Electrical

Doon, Ont. — A hydro-electric lighting system will be installed here.

Otterville, Ont.—A hydro-electric by-law will be submitted to the rate-payers on Nov. 5.

London, Ont.—Beattie Bros. are considering the purchase of a number of electric motors.

Owen Sound, Ont.—It is certain now that the power from Eugenia will be turned into Owen Sound by December 1. Construction Engineer A. S. Robertson has arrived here and is busy installing the three transformers, which will carry 1,500 horse-power. The new hydro building is almost completed and the machinery will be installed as rapidly as possible.

Municipal

Renfrew, Ont.—The town council are considering the question of obtaining more power for local industries.

Georgetown, Ont.—It is proposed to loan Henry Corke $6,000 to assist in establishing and operating a woolen mill.

Lindsay, Ont.—The town council has been successful in renting the balance of the Sylvester plant not used for shell-making to the Lindsay Wood-Working Co.

Brantford, Ont.—The city council has purchased from the Waterous Engine Works for $7,100, a combination auto hose and chemical wagon for the fire department.

Port Coquitlam, B.C.—The construction of a waterworks system is contemplated by the City Council at an estimated cost of $35,000. A by-law will be voted on.

Montreal, Que.—The Board of Control are considering the construction of an incinerator, having a capacity of 500 tons per day. The cost is estimated at $200,000.

Hamilton, Ont.—The city council is considering the establishment of a steam power plant, as a reserve, at the pumping station, as an alternative to using hydro-electric power for this purpose.

Sherbrooke, Que.—The council have engaged M. A. Sammett, an electrical engineer, to make a report as to the best means of increasing the power production to meet the demands of local industries.

Penetang, Ont.—A by-law will be voted on by the ratepayers on Nov. 8 to raise $3,500 for water main extensions.

Sarnia, Ont.—Engineer Latour, of Toronto, who is to undertake to get a plentiful supply of pure water for the new Sarnia waterworks, has completed his plans, and will start work at the new plant as soon as the contract with the city is signed. The work will, it is estimated, cost the city about $3,000.

General Industrial

Camrose, Alta.—Work has started on the new Pallesen creamery.

Toronto, Ont.—The Langmuir Mfg. Co., leather goods, will build an addition to their factory.

Southey, Sask.—A big fire occurred at Markinch on Oct. 27, when the Maple Leaf elevator, which contains about 15,000 bushels of wheat, was totally destroyed.

Halifax, N.S.—The paper mill of the MacLeod Pulp & Paper Co., situated at Milton, near Liverpool, N.S., and valued at about $250,000, was totally destroyed by fire last Monday.

Winnipeg, Man.—Owing to the rapidly increasing business, the Robin Hood Milling Co. are planning erecting more mills in the West. George A. Bean, of Minneapolis, is president of the company.

Chatham, Ont.—A deal is on for the sale of the Defiance Ironworks, on Lacroix Street, by the city to a concern in Illinois, and a committee has been appointed to leave immediately for the States to close the deal.

Kincardine, Ont.—The new knitting mill has been completed, and at a special meeting of the town council the agreement between the Circle Bar Knitting Co. and the town was ratified. The latter has made a loan to the company of $15,000, to be paid back in annual installments. Between $30,000 and $40,000 is being invested in the new concern.

Wood-Working

Meaford, Ont.—The W. A. Moore Co. are disposing of their woodworking plant.

The Manufacture of Galvanized Sheets in Canada

Staff Article

Continual evidence of this country's industrial progress is afforded by the frequent establishment of factories for the manufacture of products, the demand for which has hitherto been supplied entirely by foreign producers. The demand for sheet metal in this country assures a market which is distinctly encouraging to the organizers of this enterprise.

A NEW industry for Canada was inaugurated on September 1 last when the Dominion Sheet Metal Co. started operations at their new galvanized sheet plant at Hamilton, Ont. The plant occupies a site covering five acres, and is situated on the belt line railway, jointly operated by the G. T. R., C. P. R. and the T. H. & B. It is within a short distance of Lake Ontario, the water of which being soft and clean, is particularly suitable for the process of galvanizing. If hard water only was obtainable, the effects of lime and other deposits, which prevent the sheets from receiving the coating properly would have to be neutralized.

In normal times approximately 70,000 tons of galvanized sheets are used in Canada per year, and prior to the establishment of this plant no sheets were produced in Canada, the bulk of the supply being imported from the United States and some from England. The product of this plant bears the trade mark of "Premier," but in addition the company makes a "tight-coated" "Premier" galvanized sheet when desired. This latter is especially useful for purposes requiring extreme forming, seaming, etc. The black sheets from which the "Premier" galvanized sheets are made are specified from certain mills, and must conform to exact physical and chemical analysis. All the materials used, such as open-hearth or Bessemer black sheets, spelter, lead, tin, sal-ammoniac and acids, etc., must conform to approved chemical analysis, subject to test.

Plant Layout

The factory comprises two bays, east and west, the former being 50 ft. x 200 ft., and the latter 60 ft. x 200 ft. A spur from the belt line railway runs into the east bay for its entire length; the loading and unloading of the cars is, therefore, done under cover. By this arrangement the handling of the sheets, both black and galvanized, is greatly facilitated. In this bay is installed a 124-in. squaring shear for trimming sheets, which was built by the Bertsch Co., Cambridge City, Ind. Provision has also been made for installing any additional machines that may be required in the future.

In the west bay the entire space, with the exception of a galvanized sheet store room at the north end, is occupied by the galvanizing plant. At the south

A. T. ENLOW,
PRESIDENT AND GENERAL MANAGER.

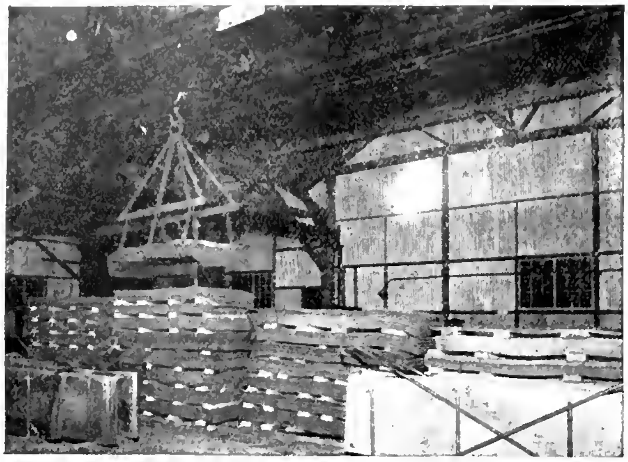
end of this bay is the black sheet storage; further along are the picking machines, washing tanks, storage tanks and galvanizing machines, while extending into the east bay are the cooling machines. The west bay has a monitor roof for providing sufficient ventilation. In handling the sheets, a five-ton electric crane is installed. The crane operates over the entire length of the west bay, and was built by the Northern Crane Works, Walkerville, Ont. When the black sheets arrive on the cars they are placed on hand trucks and weighed, and then moved into the west bay, where they are picked up by the electric crane and transferred to the store room. Here they are placed in piles, according to gauge. When undergoing treatment they are placed side up in crates, to which are attached crane hooks. An interesting feature about these crates is that they are made of "Monel" metal, each crate representing an outlay of $1,000. "Monel" metal possesses the characteristics of being able to withstand the corrosive action of the hot acid in the pickling tank and lasts indefinitely, whereas crates made of bronze would soon corrode. This metal is a by-product, and is obtained from Sudbury, Ont.

Pickling Process

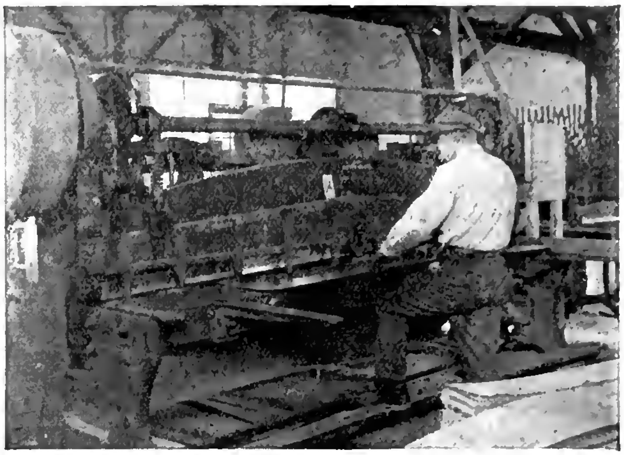
The first process consists of pickling, where the sheets are treated with sulphuric acid to remove the scale and clean the surface, so that when being galvanized the spelter will adhere perfectly to the sheet. The pickling machine consists of two plunger tanks of the latest type, each tank being 12 ft. 6 in. x 3 ft. x 5 ft. deep, and having a capacity of from 100 to 300 sheets, according to gauge, at one operation. The tanks are constructed of solid 8 x 10 in. Georgia pine, and have a bottom of lead. At one side of each tank is a plunger, also made of Georgia pine. The plungers are mechanically operated, and are used to agitate the liquid in the tanks, by which means the sheets are kept separated so that the acid may work more effectually.

There are three pipe connections for each tank for water, sulphuric acid and steam, respectively, the latter accelerating the pickling process. Adjoining the pickling machine are two independent sulphuric acid storage tanks, one for each pickling tank, equipped with floats and gauges for regulating the quantity of acid used. The acid flows by gravity to the pickling tanks. The independent acid tanks are connected to a large acid storage tank located outside the building, and having

NEW PLANT OF DOMINION SHEET METAL CO., LTD., HAMILTON, ONT.



STORE ROOM FOR BLACK SHEETS.



SQUARING SHEETS ON SHEARING MACHINE.

a capacity of 60,000 pounds. The acid is obtained from the Grasselli Chemical Co., which adjoins this plant. The steam for the pickling flush is obtained from a boiler, which will be referred to later in detail. The sheets remain in the pickling liquid for about thirty minutes, after which they are removed to the rinsing tanks.

The machinery for operating the plungers is located in a pit under the shop floor and adjacent to the tanks. The electric motor which drives the machinery is above the floor level, and is controlled by a "Wagner" polyphase motor starter. The motor is 10 h.p., 3-phase, 60-cycle, 220 volts, and was supplied by the Wagner Electric Mfg. Co., through their Toronto office.

A belt drive connects the motor to a pulley on the machine underneath, the power being transmitted to a crank shaft by a link-belt chain. A disc crank at the end of the shaft is connected by means of a connecting rod to another crank, which lifts a vertical rod up and down, thus operating the plungers. The motor starter and acid feed controller are located near together, both being within reach of the operator.

Washing Process

After the sheets have been in the pickling tanks the prescribed length of time, the crate holding them is lifted out by the crane which carries them over to the rinsing tanks near-by. These are two tanks constructed of wood, each being 3 ft. x 12 ft. 6 in. x 5 ft. deep. They contain clean, fresh water, which flows through in a continuous stream, thus effectively washing the sheets and removing all traces of acid. The sheets remain in the rinsing tanks for about thirty minutes.

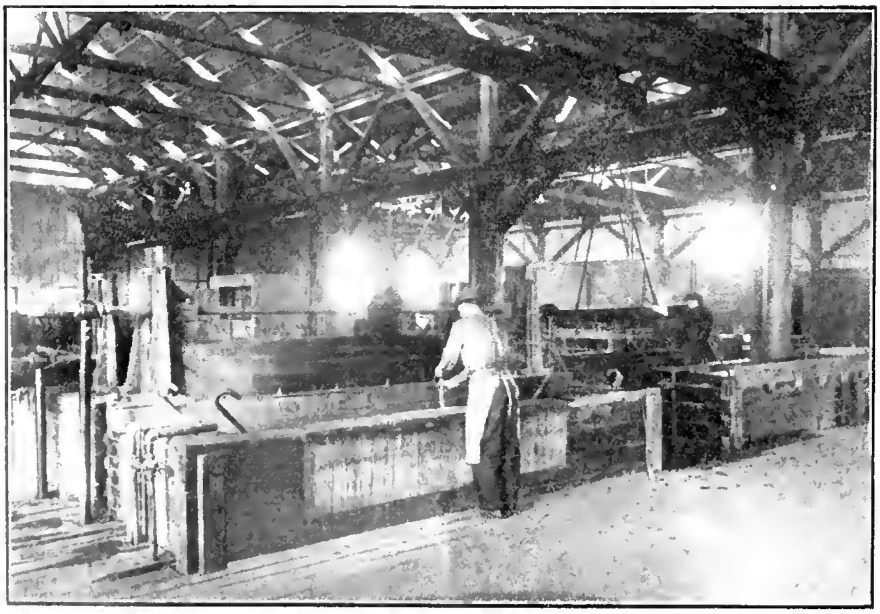
If the sheets are not to be galvanized immediately, they are carried by the electric crane to storage tanks containing water, where they remain until required for further treatment. If required at the galvanizing machine, they are carried to the feed tank direct by the crane, after having first being inspected and placed in skips laid flat. In either case they are carefully inspected before any further treatment.

There are five storage tanks, each being 4 ft. 6 in. x 12 ft. 6 in. x 3 ft. deep. They are also made of wood and contain clean water. After inspection, the sheets are laid flat in a skip, which has a capacity of about 5 tons and placed in the tank.

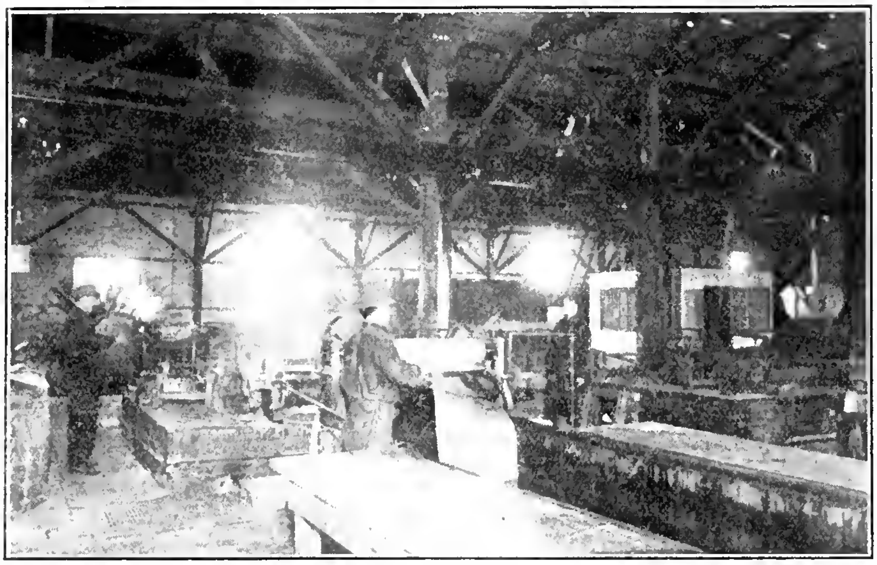
Galvanizing Process

Great care and expert knowledge is required in this operation, which consists of coating the sheets with a thin layer of zinc spelter. It will shortly be possible to obtain Canadian smelted zinc. There are two galvanizing plants installed and are operated independently of each other. Each plant consists of a "pot" constructed of brick, and having a natural gas-fired furnace underneath. The "pot" contains the spelter, one charge weighing about 80,000 pounds, and also the machine for doing the galvanizing. The pot and furnace were constructed by the company, and the machine was supplied by the Berger Mfg. Co., Canton, Ohio. An interesting feature is the C. G. E. motor controller, which has 14 speeds ahead and reverse; by this means the speed of the sheet passing through the tank can be varied, as each different gauge of metal must be coated at a speed definitely determined in advance. The motor and drive for each machine are located in a pit near the machine, and thus do not obstruct the operators. The motors are each 7½ h.p., and were supplied by the Wagner Electric Mfg. Co.

Before being galvanized, the sheets are inspected and dipped in a tank containing muriatic acid; this acid cleans the sheets, and also acts as a flux or binding medium for the spelter. The sheets are fed from the tank through a pair of 6-in. rubber rolls through a bath of salammoniac, which is a flux and floats at one end of the pot only, on top of the spelter. The sheets travel down on guides immersed in spelter through the bottom



PICKLING DEPARTMENT WHERE SHEETS ARE PREPARED FOR GALVANIZING.

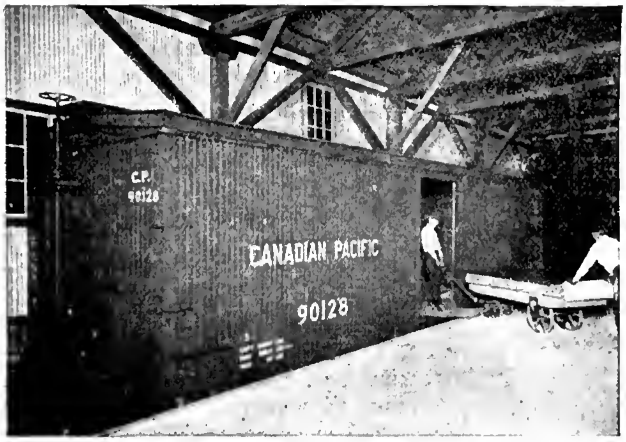


GALVANIZING MACHINE WITH FEED TANK.

rolls which carry the sheets along. The sheets then pass through another set of finishing rolls, which assist in the process, and also draw the sheets out of the pot. The speeds of the various sets of rollers vary, a feature which is carefully worked out in the construction of the drive gear. The temperature of the spelter in the pot is recorded on a pyrometer supplied by the Brown Electric Pyrometer Co., Philadelphia, Pa.

Cooling the Sheets

As the sheets leave the finishing rolls on a chain conveyor, they are carried between a series of rolls or levellers, which, as the name indicates, flattens out the sheets while hot. The sheets are then carried a short distance on another set of rollers to a table in front of the revolving cooling racks. On this table is a trip gear automatically operated, which places each sheet in position on each rack as the latter comes round. The cooling machine revolves very slowly, and, while doing so, compressed air



SHIPPING "PREMIER" GALVANIZED SHEETS.

is played on the sheets, giving to the smooth silvery surface that spangled appearance which distinguishes all galvanized sheets. The accompanying illustration will give the reader an idea as to the type of machine used for the cooling process. There are two of these automatic cooling machines installed, both having been built by the United Engineering and Foundry Co., Pittsburg, Pa. The cooling machines are operated by the motors that drive the galvanizing machines.

By the time the sheets have travelled over to the other side of the cooler they are cool. They are then taken from the racks, placed on trucks and carefully inspected on both sides for any imperfection. Any sheets that are imperfect are placed on one side, while the perfect sheets are branded. The sheets are now finished and are loaded into cars, which are inside the shop, or are bundled, weighed, and taken to the warehouse to await shipment when required.

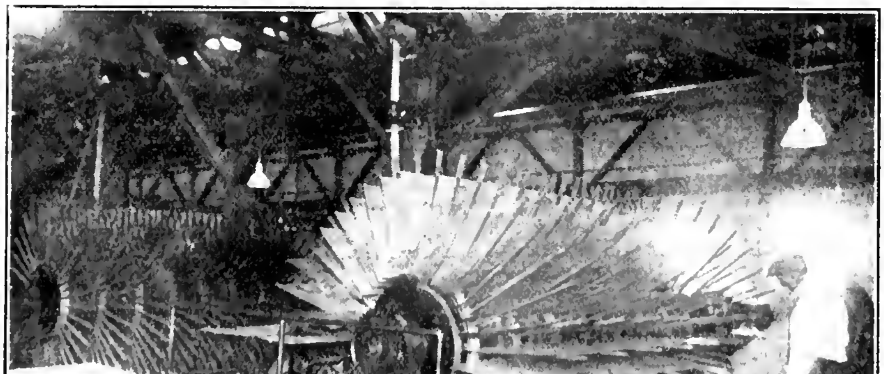
Heating and Lighting Feature

The boiler for heating the plant is located in the warehouse. The boiler is rated at 30 h.p., is of the horizontal return tubular type, and was built by E. Leonard & Sons, London, Ont. It is fired from waste heat from the galvanizing pot furnaces, but is also equipped with gas burners as a stand-by. This boiler also furnishes the steam for the pickling tanks.

Current from the Hydro-Electric system is used throughout the plant for the motors and the lighting system. In connection with the latter there are a number of 600-watt tungsten lamps installed, which give an exceptionally bright appearance to the interior of the shops. The offices are located in a separate building. On the property is a pond used for receiving the discharge from the acid tanks, a considerable saving in operating expenses being made by means of this.

Although the plant has only been in operation for a comparatively short period, the company has been very successful in producing a high-class sheet. The president and general manager of the company, A. T. Enlow, has had a lifelong experience in the sheet metal business, and is ably supported by an efficient technical staff. The company has thus been spared many of the troubles which would doubtless handicap a concern embarking on a new venture of this description under less favorable conditions.

The control of the mind as a working machine is the end of all education. This can be accomplished with deliberation.



INSPECTION DEPARTMENT AND AUTOMATIC COOLING MACHINES FOR FINISHED SHEETS.

COPPER IN AMMUNITION

AMONG the many and varied uses of copper, its consumption in the manufacture of ammunition is not the least important, as is attested by the fact that some 20,000,000 lb. of copper is used for this purpose each year in the United States alone, in spite of the small degree to which military preparation for war is here developed. Within the past few months huge orders for the ammunition required in Europe have been placed with firms in this country, many of them concerns formerly engaged in making other kinds of goods, but who are not unwilling to modify their plants and procedure in order to benefit by the high prices paid for quick delivery of the various munitions now being consumed so lavishly. It is impossible to estimate how much copper is now being used for this purpose, but some idea may be gleaned from the way in which the price of the metal has risen in the past few months, and continues to rise in spite of the efforts of the mining companies to increase their output.

When copper in ammunition is mentioned, the natural association is with the brass cartridges used for ordinary rifles. Greater interest attaches to the cartridge cases for quick-firers and field guns. The case of the cartridge for a 3-in. gun weighs 1 lb. 5 oz., while that for a 6-in. gun weighs 28 lb. 14 oz. As in a million rifle cartridges only 23,000 to 26,000 lb. copper is used, it is seen that the greater weight of the larger cartridges tends to compensate for the less frequency with which they are fired. But there are other uses of copper in ammunition. Every shrapnel shell must have a copper band about it in order to prevent the escape of the gases of the explosion past the projectile; these rings average 2½ to 3 lb. in weight per shell. The copper expands under the impact of the explosion and makes a tight fit against the sides of the gun. This saves the wear caused by the rush of the gas past the projectile and increases the power of the gun; it also makes the projectile follow the rifling better.

Every cartridge requires a primer; these are made of copper or a soft brass rich in copper. The old-style lead bullet is not suitable for use in the modern high-power rifles, so the projectile is commonly made with a hard jacket over a lead core. An alloy of 85 per cent. copper and 15 per cent. nickel is the most suitable for this purpose. The Germans use sheet-steel cases for bullets, plating them to protect them from rust. The steel is believed to wear the rifling of the barrel more rapidly than cupronickel, but does not foul it so quickly, being harder. One of the armies of Europe uses a solid brass bullet. The lead used in all projectiles, especially shrapnel, contains antimony, hence the present demand and high price of that metal.

Spelter advances with the demand for copper in war. The brass used in the making of ammunition must be of the best quality, containing about 70 per cent. copper and 30 per cent. zinc, so it will not crack in working, nor be destroyed in firing, as all cartridges are reloaded. The specifications of the United States Army require cartridges to stand twenty reloadings without failure. The reason for this is that the case of a rifle cartridge costs 1½ cents, while the complete cartridge costs only 2½ cents, thus it is good economy to reload as often as possible. In making a case, flat discs are stamped out of brass sheets of the requisite thickness. The next operation cups the disc, and by a series of these it is formed into a cylinder, "necked-down" to the shape required, and the head is finally formed from the thick metal left in the base. After each operation the brass must be annealed, as the working makes it hard and it would crack on further working. Both the copper and spelter must be pure, as impurities make the brass hard and cause it to crack. Good electrolytic copper is pure enough, but the spelter must be purer than ordinary brands, which contain too much lead for this purpose. Spelter made from the franklinite and zincite ores of New Jersey and the blende from Tennessee, which are free from lead, therefore commands a premium over prime Western. This premium has recently been large enough to warrant the redistilling of ordinary spelter in order to purify it. Another reason for using brass of the highest quality should be pointed out. Brass is used for cartridges rather than copper, because the cases must possess sufficient resilience to spring away from the sides of the gun-chamber, after firing; otherwise the shell cannot be extracted, and the gun is temporarily out of commission. This is especially important in the case of quick-firing guns. If the case splits or cracks, it will stick in the chamber.

As previously stated, all cases are reloaded. But it must be remembered that it is a long way from Bukowina to the Naugatuck Valley of Connecticut, while many shells are lost on the battlefields and will not find their way back for reloading for a long time. Orders for ammunition are being based on immediate requirements; in the event of the war being protracted the rate of consumption will probably decline, and when peace is concluded enormous quantities of scrap brass will find their way into the markets of Europe. What effect this is likely to have on post-war copper consumption it is difficult to prophesy.—Queensland Mining Journal.

LUBRICATION OF PORTABLE AIR TOOLS

ENORMOUS numbers of compressed air hammers, drills, and other portable tools are in regular service in various engineering and mining services, and it is safe to say that a very large percentage of these tools are working at less than full efficiency and wearing out unnecessarily fast owing to improper lubrication. The volume of air passing through even the smallest tool is very large, and it has several prejudicial tendencies. In the first place, it tends to blow oil away from the air valves and piston into the exhaust passage, particularly since a thin oil is necessary for these high-speed parts. It tends also to oxidize any oil which is of a "drying" nature or contains oxidizable adulterants, and any "gumming" naturally means decreased efficiency and increased wear. Finally, unfiltered air carries with it dust in amounts which will only be appreciated by those who have had experience with air filters. Unless the latter be used, particles carried by the air will be deposited in the air compressors and air tool to the detriment of glands, valves, and cylinders.

Quite a simple air filter, consisting of several layers of muslin over a wood or wire framework, is sufficient over the air intake of the compressor, and efficient filter nipples are on the market for instant connection in any compressed air line supplying individual tools. By thus keeping dirt out of the tools half the battle of efficiency and durability is won. For the rest it suffices to give the working parts of the tool a thorough washing with paraffin once a week at least and once a day if the service is very heavy; and to lubricate liberally and regularly during working. A thin machine oil is suitable for hammer pistons and valves, and a supply should be given every hour or so during regular working. Gear and crank cases should be filled with high quality grease once a shift. In the air compressor itself it is best to use one of the special graphite lubricants, since accumulations of oily matter in air containers and pipe lines are apt to cause spontaneous combustion and explosions.

YOUR GREATEST work—a work in which there can be no failure for the earnest and sincere man—your greatest opportunity in life, will be found shoulder to shoulder with your fellow-man, doing the things good for all of us. Thus in serving yourself, you will serve your neighbor, your community, your state and your nation. You will be doing your work in helping to perpetuate the civilization of the entire world.

Presses for the Manufacture of Shells and Shell Cases *

By William Rodger **

The question of the best type of press to install for the production of steel shell forgings or brass cartridge cases appears to be more or less an open one. In the discussion following the reading of the accompanying paper, both power and hydraulically operated presses were championed, although operations of varying nature occasionally call for discrimination.

IN connection with the manufacture of cartridges and shells, the question raised is whether an hydraulic or power type is the most economical and efficient press for the manufacture of cartridges and shells. The writer is fully aware that economy in some cases is unattainable if the plant has been laid out for the manufacture of material other than the work above designated, but by careful attention to the lay-out, economy can be attained. It is purposed in this paper to deal with the following types of hydraulic and power plant presses:—

1—Steam pump press.
2—Motor driven pump press.
3—Motor driven power press.
4—Direct steam press.

Steam Pump Press

Boilers are required to generate steam to drive the pumps, and the pumps must be sufficiently large to supply the water at the required pressure and velocity to keep up the accumulator when the presses are in operation. It is absolutely essential that a receiving tank should be installed, having a direct connection with the water main and in order to prevent the pumps drawing air, care should be taken to ensure a sufficient height of water being maintained above the suction pipe at the pump. The water so pumped into the accumulator, performs the work in the press and exhausts back to the receiving tank, thus setting up a standard of economy in the supply of water. A stop valve should be fixed in the main intake to close the water supply when the pump is not in operation and thus guard against an overflow of the tank. In this type of press, economy in steam power can be attained by the use of a trip valve operated automatically, which cuts out the steam when the press is not in operation.

It is policy, when installing this type of press, to make the pumps 25 per cent. larger than actually required, and the writer is also of the opinion that it indicates good judgment on the part of the engineer, as at times the pump is liable to give out with an overload on the press. The pressure of water per square inch is obtained by the steam pressure on the piston, and the load is transmitted through the crank shaft to the plungers; consequently any pressure per square inch can be attained. An hydraulic intensifier is capable of transforming low pressure, as from a main, into a useful hydraulic pressure, therefore, by this means, additional pressure can be transmitted to the accumulator.

The accumulator is undoubtedly the most important adjunct in hydraulic transmission, constituting an artificial head, by which the pressure of water is transmitted to the press by the aid of

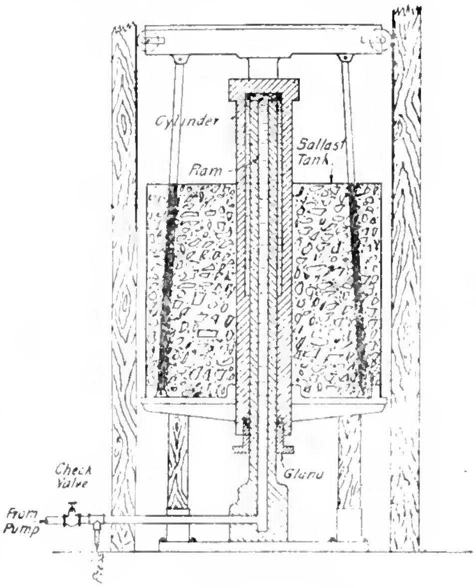


FIG. 1. ACCUMULATOR.

material in addition to water power. Fig. 1 illustrates an accumulator having a ram 21 feet long, 12 inches diameter and 4 inches thick. The lower part of the ram is cast with a tapered collar 14 inches in length having a diameter sufficiently large to ensure a pressure of not more than 545 lbs. per square inch on the supporting surface; there is also an elliptical boss on collar for pipe connection. From the collar to the lower extremity, the diameter of the ram is 18 inches and the length 21 inches. It is machined to gauge to fit into the bottom base. The base is made of cast iron about six feet square and six inches thick, and is bored to gauge to receive the ram.

The cylinder is a large cast iron pipe closed at the upper end and surmounted by a cross-head to which are attached stay-rods leading to the floor of the ballast drum. The lower flange of the cylinder carries the ballast drum, and immediately below this flange, the cylinder is extended to form a stuffing box. The gland is also made of cast iron, being cast in halves in order to facilitate packing.

The ballast drum is about ten feet in height, having a diameter also of ten feet. It is made of quarter inch plates riveted together, having 4 x 4 x ½ angles at the bottom and 3 x 3 x ½ at the top. The lower plate of the drum is of ¾ inch boiler plate made in halves, having tees riveted at the bottom, radiating from the centre to the outer edge to which the stay rods are pinned. It is essential that the stay rods should be made strong to stand the stress due to weight of the ballast in the drum.

On a ram 12 inches diameter, having a similar size of drum, the quantity of ballast required to maintain a pressure of 1,500 lbs. per square inch would be approximately 145,000 lbs. The ballast preferred for this purpose would be iron cuttings and punchings. The following is the ratio of various materials which could be used as ballast:—Pig iron, 6.25 cubic feet per ton; broken stone, 17.2; clay or earth, 18.5; bricks, 22.2.

The accumulator requires to be fixed on good concrete foundation, about six feet deep by eight feet square, made amply strong to carry the load and the weight. Between the accumulator and the pump is placed a by-pass with pilot valve. This is operated automatically by the upstrokes of the ram, which contacts with a weight connected with a wire rope travelling over a pulley fixed to the roof or girder of the building, and joined to lever of the pilot valve, thus reversing the action of the water and closing the connection from the pump to the accumulator. The service pipe to the press, the absorber, and the check valve are fixed between the by-pass valve and the accumulator. The absorber is used to reduce the shock when accumulator is in operation and in turn the check valve prevents the return of the water to the pump.

Hydraulic Press.

The position of the presses should be known relative to the pump and accumulator in order that the pipes may be arranged to eliminate right angle bends, thus preventing sudden shocks and bursting of pipes, which would materially re-

*From a paper before the Canadian Railway Club, Montreal.
**Elevator Draftsman, C.P.R., Montreal.

tard the output. It is desirable that the pipe leading from the pump to the accumulator should be larger than the pipes leading from the accumulator to the presses.

A loss of power occurs when flowing water passes round a sharp bend or angle, or when it is subjected to sudden force. When easy bends are used there is practically no loss of energy in this direction, but with sharp bends and elbows the loss may be greatly increased. These facts point to the necessity of avoiding, as far as possible, all sharp edge inlets to ports. The best results are obtained when the water passages from the pump to the press are designed so as to ensure all the changes of direction and velocity being as gradual as possible.

If a hydraulic plant is well designed, the loss of useful effect between the pump and an accumulator properly packed, is but little. After various researches the writer found that Mr. Tweddell had compiled some careful records of the working of two pumps delivering water to the accumulator. What

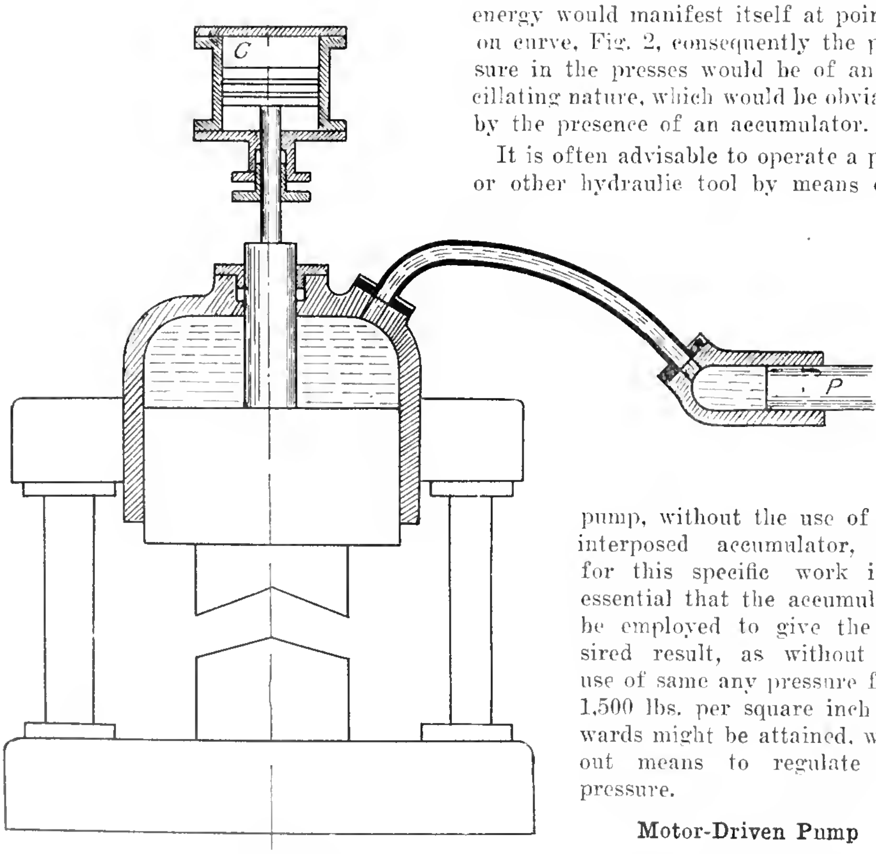


FIG. 3. "ALLEN" PRESS.

he found to be the theoretical delivery for twenty strokes of one pump to raise the ram to the exact height was 1,694 cubic inches of water, whereas the actual delivery was 1,614 cubic inches only, consequently a loss of 4¾ per cent. With both pumps working for a similar number of strokes, the theoretical delivery was 3,388 cubic inches, whereas the actual was 3,278 cubic inches, showing a loss of 3¼ per cent. only.

At the time these experiments were made, it was noticed that the ascending pressure in the accumulator indicated 1,250 lbs. per square inch, while the de-

FIG. 2. PUMP DELIVERY CURVE.

scending pressure indicated 1,225 lbs. per square inch. Thus, it will be observed, in the ascending stroke, in addition to lifting the load, the pumps had to overcome the friction, and the descending friction, as will be readily appreciated would be half the difference of pressure in both instances, i.e., 12½ lbs. per sq. inch, equivalent to one per cent. of the total pressure.

In the manufacture of cartridges and shells, the writer considers that the use of an accumulator is indispensable. To illustrate this point; should a triplex pump, which gives a more even flow of water pressure, be used, a certain loss of energy would manifest itself at point A on curve, Fig. 2, consequently the pressure in the presses would be of an oscillating nature, which would be obviated by the presence of an accumulator.

It is often advisable to operate a press or other hydraulic tool by means of a pump, without the use of any interposed accumulator, but for this specific work it is essential that the accumulator be employed to give the desired result, as without the use of same any pressure from 1,500 lbs. per square inch upwards might be attained, without means to regulate the pressure.

Motor-Driven Pump

This type of hydraulic plant is operated by a steam-driven generator which supplies current to the motor driving the power pump. The electrical generator is driven by a high-speed engine, having a short cut off, which consequently will use less steam and consume less coal than a high pressure steam pump. This class of engine will use steam at the rate of 10.8 to about 20 lbs. per i.h.p. hour, while a steam pump working at 150 lbs. boiler pressure would use approximately 80 lbs. per i.h.p. hour. Hence the motor driven pump has the advantage over the direct steam pump, and the effect is a saving of four to eight times, which would more than cover the cost of the auxiliary plant.

The most efficient power pump that will overcome the trouble due to uneven flow of water is the triplex pump, for in this type the pulsations overlap each other, the cranks being set to 120 degrees apart, in such manner that the combined discharge from the cylinder is practically uniform in quantity and pressure.

Motor Driven Power Press

This type is purely mechanical, and is operated by an electrical motor arranged in any suitable way. There are many ways of driving the power press, and it is the opinion of the writer that the best method is by a motor-driven countershaft, which obviates the necessity of a special self-starting rheostat.

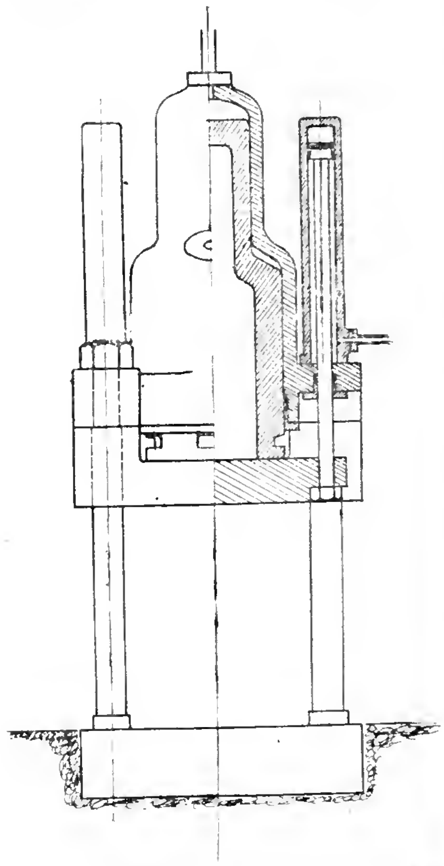
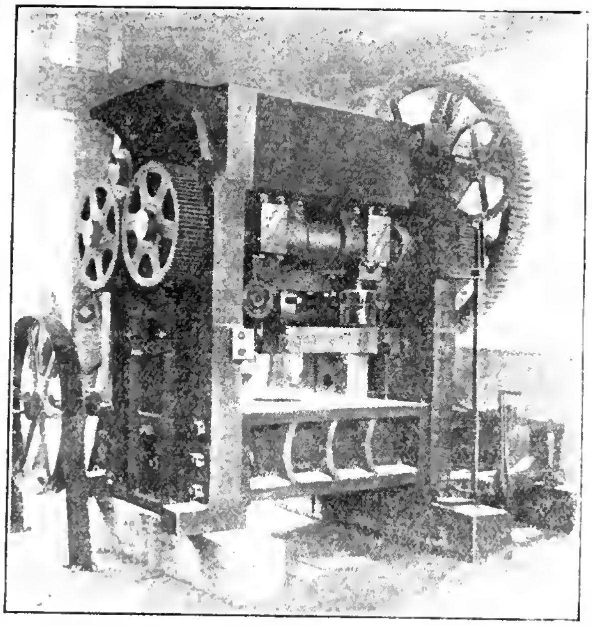


FIG. 4. TANDEM CYLINDER HYDRAULIC PRESS.

In connection with the above type of press, to obtain an even pressure, Taylor & Challen, England, found it necessary to introduce four cranks with connecting rods operated by two crank shafts, and from the illustration it will be seen how the drive is effected.

The other type of press is oper-

ated by motor, the power being transmitted through a worm. The worm is screwed right and left hand, with a crosshead placed on each side, and the moving table has a vertical guide bar fixed thereon, which slides through the top platen. The vertical motion is made by four links, two of which are fixed to the top platen, and two to the guide bar, and connected to crosshead on either side. When the worm revolves the crosshead travels inwards towards the centre and presses the table on the material and vice versa releases the pressure.



FOUR-CRANK POWER PRESS BY TAYLOR AND CHALLEN, LTD.

Direct Steam Press

This type would not be suitable for shell or cartridge making, as it is not possible to attain the required pressure per square inch at the back of the piston. The expense likely to be incurred in the installation of a high pressure boiler for this work would be far too great, for, in addition, the introduction of a crank system would be required to attain a pressure of 800 lbs. per square inch.

Having dealt with the four types of presses, the writer will endeavor to demonstrate the superiority of the hydraulic press with a motor driven pump, as compared with the steam pump press and a motor driven power press. Before entering into details it will be interesting to note the records made by Professor Robinson:—

Flow of Solids.—Hydraulic forging has revolutionized the treatment of large masses of iron and steel by enabling immense pressure to be brought to bear on hot metal plates, or masses of iron and steel. By means of fluid compression, ingots are produced of a soundness which was hitherto impossible of accomplishment, and by hydraulic pressure masses of metal can be squeezed into required shapes far better than by blows from a steam hammer.

The employment in recent years of iron in increasingly large masses has involved the consideration of how the continuity of the fibre can be maintained and what the conditions are which have to be observed in order to prevent break of continuity, or a diminution of the calculated strength of the mass. Investigations by the late Mr. Tresca, recorded in the Proceedings of the Inst. of Mechanical Engineers (dated 1868 and 1878), have thrown light on the subject and would be of practical value with regard to forgings made under pressure or squeezed, instead of being forged under a hammer and formed by means of blows. Mr. Tresca applied the expression "the flow of solids," and the singular fact he established indicated that an entirely new branch of observation had been opened out, to which M. De St. Venant gave the name of Plastic Dynamics.

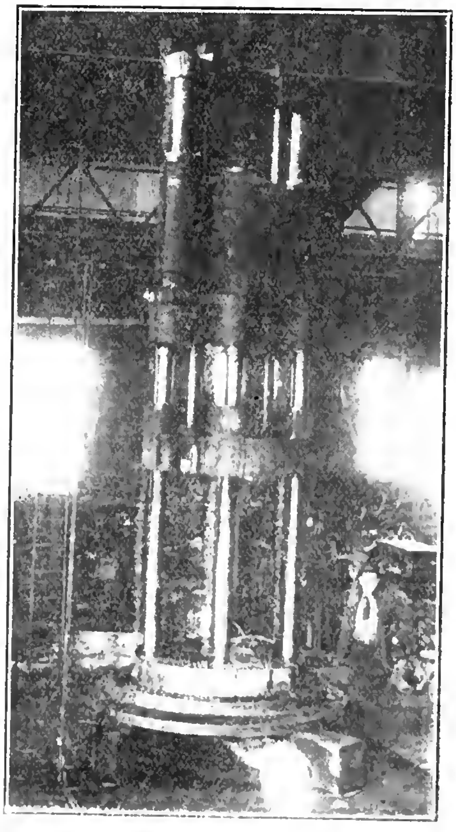
Presses for 18-Pounder Shrapnel Shell Forgings

The presses for the manufacture of 18-pdr. shells are fixed on a concrete foundation surmounted with a cast iron base through which four steel columns, eight inches diameter, pass, and are held at lower extremity with solid hexagon nuts. These columns support the main cylinder by means of a collar, and are also held in position by solid hexagon nuts. The columns also guide the moving table which is bushed in halves to facilitate the placing or the replacement of the bushes, and a retaining ring is used to hold the bushes in position. The draw-back cylinders are bolted to the main cylinder and the rams are made fast to the crosshead and connected to the moving table by two columns of about five inches diameter. In this manner the pressure is released from the tools.

The height of the press complete is approximately 21 feet and there are two classes: The first has a capacity of 350 tons pressure, the second having a capacity of 225 tons only. The presses are constructed having the main ram common to both, while the difference of pressure is accounted for by the diameter of the draw back cylinders, which in this instance would be 8 and 10½ inches, respectively. The stroke of the ram in the former press is thirty-six inches and in the latter forty-five inches.

In the production of heavy forgings from large ingots of mild steel, it is essential that every part of the ingot should be equally worked if the resultant forging is to be homogeneous in structure. Where a steam hammer is used, the energy of the blow is absorbed in producing distortion of the outer layers while the interior is practically unaffected. This disadvantage is overcome by the use of the hydraulic forging press with its slow and powerful compression, it gradually supplanting the steam hammer for the production of very heavy forgings.

The "Allen press (Fig. 3) works on a very ingenious principle. Here a pressure accumulator is necessary, likewise the valves in the high pressure water column. For its operation a low water pressure supply, approximately of 200 to 300 lbs. per square inch, is necessary, and during the idle part of the stroke this follows up the ram, the high pressure connecting pipe being kept full. In the meantime, when the pressure is required, this supply is cut off and communication is made with the high pressure pump. The pump has no valves, hence the ram has a continuous up and down motion, the water column simply following the motion of the pump plunger. The momentum of this column thus has a useful effect in increasing pressure on the ram at the end



HYDRAULIC PRESS FOR PRODUCTION 18-PDR. SHELLS.

of the working stroke. A steam cylinder is usually provided for lifting the ram.

Fig. 4 shows a type of hydraulic press having two cylinders with two draw backs, to which the pressure is supplied by an accumulator and an intensifier. It can be operated for three distinct loads, and is constructed to carry any load. The top cylinder is of 21 inches diameter and the lower cylinder has a diameter of 36 inches. It will be readily seen that this type of press is particularly advantageous and can be profitably adapted to the manufacture of shells, heavy forgings, cartridges, etc.

The hydraulic press has the advantage over the power press, as it is necessary for the latter to have some means of bringing down the moving table, either by a crank or toggle arrangement. A power press with crank, having a short travel similar to press manufactured by Taylor & Challen (already described) would not be practical for this specific work, as a stroke of 36 to 45 inches is required. The crank motion also has a tendency to fly out on a tangent, thus causing the tools or dies to get out of line. With the toggle arrangement a similar trouble would be experienced, although the travel required would be attained.

Cartridge Case Heading and Indenting

In the manufacture of cartridge cases presses are built for indenting and heading 18 pdr., and 4.5 sizes. It was found for this particular operation that the pressure required was 800 tons. The cylinder of the press is made of cast steel, similar in shape to a goblet, with a cast iron ram of 36 inches diameter, the lower portion being 8 inches diameter only, to serve as a guide for the main ram, in which a hole three inches in diameter is cored to the bottom of the guide, in order that the benefit of 36 inches area might be derived. The four columns are carried by four lugs cast on the upper part of the cylinder, the columns being surmounted with a cast steel platen.

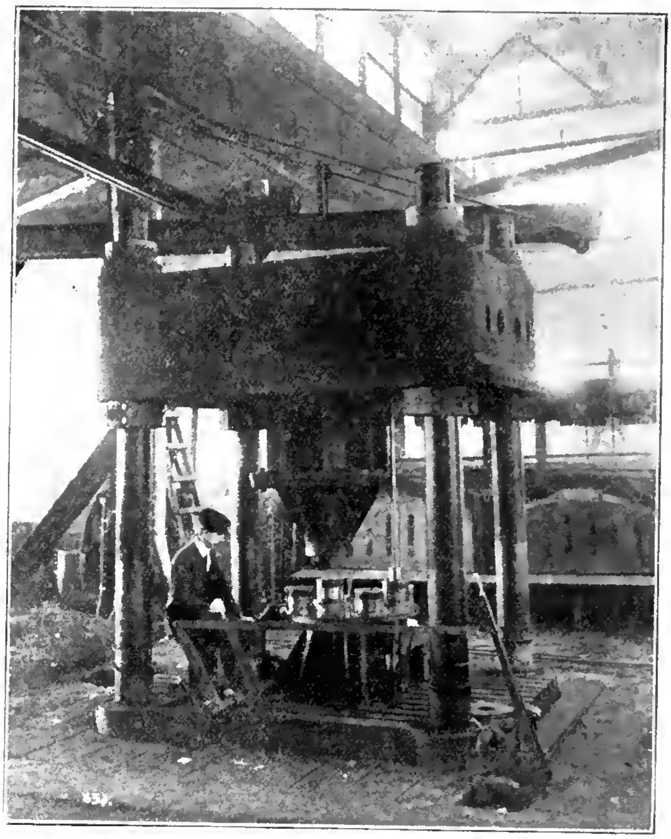


FIG. 7. 500-TON HYDRAULIC PRESS.

A fixed table is bolted to the top of the ram above which a movable table is fixed, riding on ball-races, for the purpose of facilitating the operation of bringing the dies to dead centre; the dies being kept in position while indenting and heading by notches cut at equal distance on the outer edge of the revolving table.

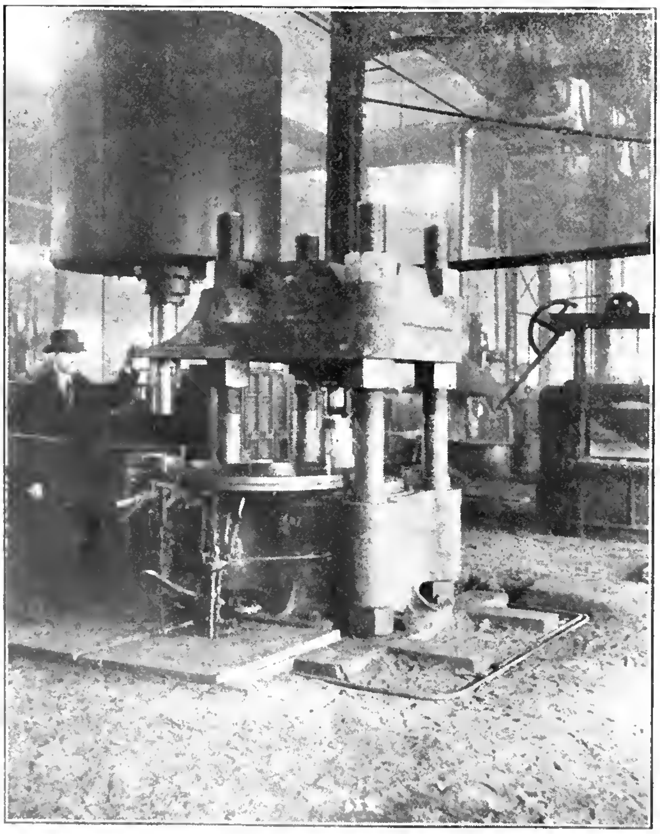


FIG. 6. 800-TON HYDRAULIC PRESS FOR CARTRIDGE CASE HEADING AND INDENTING.

It is very important that the work of indenting and heading the cartridge be accurate, and the press most suitable for this class of work is without doubt the hydraulic, as although the required pressure can be attained by the power press, its accuracy cannot be relied upon. The material in present use is bronze and the cartridge on completion of the operation of the hydraulic press is isotropic. In other words, the stress is equal, both lateral and vertical. This could not be attained by the power press, because of unequal pressure, its agencies being contrary to downward motion, and the result an irregular section.

1916 FOUNDRY EXHIBIT AT CLEVELAND

AT a recent meeting of the executive committee of the American Foundrymen's Association at Cleveland it was decided to receive bids for the conduct of the exhibition of foundry machinery and supplies which will be held in connection with the convention at Cleveland next year. For several years the exhibition has been under the control of the Foundry & Machine Exhibition Company. It is understood that bids are to be opened Nov. 13 at Cleveland, and that the successful bidder will manage the exhibition for the foundrymen, the net profits to go to the associations and the exhibitors.

ECONOMICAL VANADIUM IRON CASTINGS

THE problem of cheapening production without impairing quality is one that is always with us, and it will be of greater importance than ever in the years of industrial rivalry following the war. The use of the cheapest suitable materials is by no means the least fruitful of the many possible fields of economy, and in this connection it is interesting to note

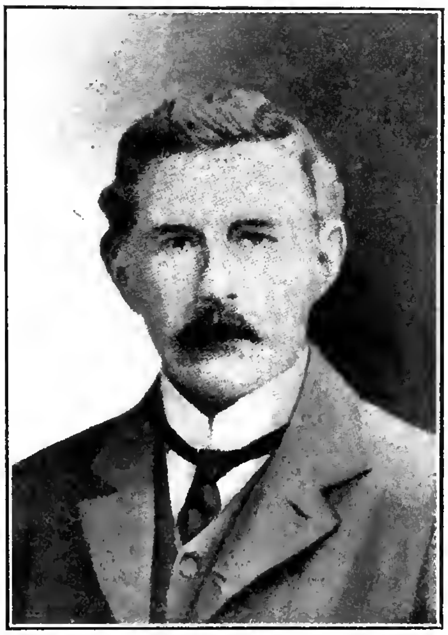
the results of a series of tests recently conducted by Prof. Fitch on vanadium castings. It appears that a pig iron containing silicon 2.00; sulphur, 0.02; phosphorus, 0.58; manganese, 0.69; carbon, 3.62 (0.55 combined); titanium, 0.022; and vanadium, 0.04 per cent., has unusually high scrap-carrying abilities and that nothing is to be gained from using a mixture of pig iron and scrap containing a large proportion of pig iron, even for automobile cylinders, or other work requiring soft, dense, machinable metal.

A series of tests was conducted on castings containing from zero to 80 per cent. scrap of the following composition: Silicon, 1.74; sulphur, 0.09; phosphorus, 0.49; manganese, 0.36; carbon, 3.30 (0.75 combined); titanium, 0.04; vanadium, 0.01 per cent. It was found that the test data lay between the following limits for specimens with from 20 to 80 per cent. scrap, the bracketed figures referring to pure pig specimens: Tensile, 22,000-26,500 (25,200) lb.; modulus of transverse rupture, 48,000-55,000 (50,600) lb. per sq. in.; deflection (12-in. centres), 0.086-0.116 (0.097) in.; shrinkage per foot, .11-.125 in. (.11 in.) in green sand and .125-.15 in. (.13.) against a chill; scleroscope reading (tool steel 100) 35.3-36.1 (36.3); pouring temperature, 2,125-2,475 deg. F. (2,280 deg.). These figures give a good indication of the scrap-carrying capacity of the pig and of the strength and resiliency of vanadium castings.

Using pig of the composition stated and scrap not differing much from the above analysis, it is recommended that a 50 per cent. mixture be used for all but heavy castings (wherein no part is less than 2 in. thick). Sixty per cent. gray iron machinery scrap gives good medium castings, and no less than 80 per cent. scrap can be used for heavy casting. Castings of these compositions are claimed to be easy to machine, soft and close grained, and easily susceptible to high polish. The possibilities of high-scrap, vanadium castings are distinctly worth bearing in mind for practically all classes of work.

THE CAUSE OF RUPTURED FLY-WHEELS

WHEN a flywheel cools after casting, the rim and central boss remain hot much longer than the arms, and thus continue to shrink after the arms have set rigidly. This is where the mischief occurs. The shrinking rim and boss subject the arms to mixed stresses, and the arms resist the shrinkage of the rim and boss. The net result is that, though the wheel does not fracture at the time of cooling, yet it is in such a condition of internal stress of tension that a slight excess of speed of revolution above the normal is liable to fracture it. The majority of the fractures of flywheels originate from this cause alone. A great deal can be done, however, in proportioning the rim, arms and boss, or by hastening the cooling of the rim and boss, and delaying that of the arms, so that the cooling shall take place in about equal times. This is properly done in cast iron flywheels, but as there is always an element of risk, the practice has grown of abandoning such wheels in favor of those built up in separate pieces, bolted together, and in another direction of using arms of wrought iron in rims and bosses cast around the ends of the arms. Therefore, though cast iron is used for wheels of small and moderate dimensions, the composite wheels are almost invariably used for those of large dimensions.



W. L. HICHENS, ESQ.,
Chairman Cammell, Laird & Co., Birkenhead and Sheffield, England, who has arrived in Canada to assist in the work of organizing munitions production.

MILL CONSTRUCTION

MILL construction consists in so disposing the timber and plans in heavy and solid masses as to expose the least number of corners or ignitible projections to fire, to the end also that when fire occurs it may be most readily reached by water from sprinklers or hose.

It consists in separating every floor from every other floor by incombustible stops—by automatic hatchways, by encasing stairways either in brick or other incombustible partitions so that a fire shall be retarded in passing from floor to floor to the utmost that is consistent with the use of wood or any material in construction that is not absolutely proof against fire from any source.

It consists in guarding the ceilings over all specially hazardous stock or processes with fire-retarding material, such as plastering laid on wire-lath, or expanded metal, or upon wooden dovetailed lath, following the lines of the ceiling and of the timbers without any interspaces between the plastering and the wood; or else in protecting ceilings over hazardous places with asbestos air-cell board, sheet metal, "Sackett" wall board, or other fire-retardant.

It consists not only in so constructing the mill, workshop or warehouse that fire shall pass as slowly as possible from one part of the building to another, but also in providing all suitable safeguards against fire.

Vertical openings throughout buildings as far as stairs and elevators are concerned, rapidly communicate fire to all storeys. With buildings of considerable height or combustible contents, this is likely to result in fire conditions beyond fire department control. All such floor openings should be enclosed in brick-wall shafts, crowned by thin glass skylight, and extended through roofs having fire doors with openings to storeys. Enclosed vertical openings are considered to be the most prominent features contributing to fire cost and loss of life. Neglect to guard these openings is common. Pains should be taken to rectify this condition in all existing buildings as well as in those hereafter erected, particularly if of mercantile, manufacture or storage occupancy.—Ex.

MUNITIONS CLASSES IN SCOTLAND

CONSIDERABLE interest is being evinced in these classes, and already between 1,200 and 1,300 applications from intending students have been received by the governors of the Glasgow Technical College, although the classes must, for the present, be limited to thirty workers at a time. At the moment this is the total number of lathes available, and, withal, larger engineering works being so fully occupied on Government contracts, the only possible chance of increasing this number is to get some on loan from smaller tradesmen who might be able to spare them.

WATER meters in London, Ont., numbered 2,562 January 1, 1915, an increase of 486 during the previous year. Only 17 per cent. of services are metered, although 24 per cent. of the water consumed passes through meters and furnishes 40 per cent. of the revenue. Each inhabitant of this town of 56,000 population consumes on the average 81 Imperial gallons per day and the cost of the water is $34.15 per million gallons.

PROGRESS IN NEW EQUIPMENT

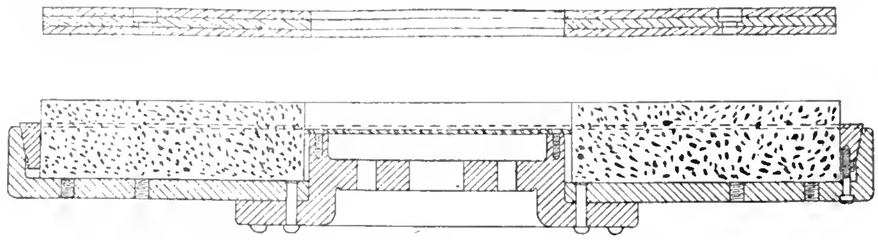
A Record of New and Improved Machinery and Accessories for the Machine, Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

WIDE FACE RING WHEEL GRINDER

An improved flat surface grinder of the ring wheel type has just been placed on the market by Charles H. Besly & Co., 120 North Clinton St., Chicago. This machine is called a Besly Wide Face Ring Wheel Grinder, and as shown in Fig. 1, is similar to the single spindle lever feed Besly disc grinder except that for roughing off scale and excess stock one end of the spindle is equipped with a pressed steel chuck holding a wide face vitrified ring wheel. This grinding wheel has 8 inches to 10 inches width of grinding face, so that work may be allowed to "float" on this broad face, while grinding; same as is done on the usual steel disc wheels covered with cloth abrasive discs.

These vitrified grinding wheels are more efficient and economical than cloth back abrasive discs for heavy rough grinding on scale; in fact, large rough work may be accomplished on the wide face ring wheel grinder which cannot be done at all on the ordinary disc grinder.

Besly grinders have, heretofore, been equipped with ring wheel chucks for rough grinding, but with comparatively narrow-faced ring wheels which made it necessary to rigidly clamp any work which was to be ground. The advantage of the wide face ring wheel as compared with the original narrow face ring wheel is that much work may be "floated" against the wide face wheel as in disc grinding and ground without clamping. This saves time in chucking. There is a further saving in the time of grinding because with the wide face ring wheel more cutting points are in action, as it grinds all over the face of the work at once—side swiping. The opposite end of spindle is equipped with the usual steel disc wheel set up with cloth back abrasive discs for finish grinding.



PRESSED STEEL CHUCK WITH CLAMP RING AND LAMINATED PACKING PLATE.

Chuck body is pressed steel, double riveted to a cast iron centre. Construction of this centre is such that spindle bearing projects into the chuck, thereby minimizing overhang. Chuck body is drilled and tapped from the back to receive headless threaded plugs for balancing. Grinding wheel is held in the chuck by pressure over its periphery. This pressure is applied by means of a wrought steel tapered clamp ring, passing around the grinding wheel. This ring is drawn into the tapered chuck body by means of clamp screws operated from the back of the chuck body. A suitable steel plate is provided to fit the centre hole of the grinding wheel and guard the heads of the screws which hold the chuck on the grinder spindle; so there are no external projections. This makes the chuck especially safe. As grinding wheel wears away, it may be set out in the chuck by means of a laminated wood plate supplied with the chuck.

The Besly wide face ring wheel grinder is built in two sizes: No. 17 carrying vitrified grinding wheel 24-inch diameter, 8-inch hole, 8-inch width of grinding face, illustrated in Fig. 1, and No. 16 carrying vitrified grinding wheel 30-inch diameter, 10-inch hole, 10-inch width of grinding face. All ring wheels are 3-inch thick when new and may be worn down to 1 inch in thickness.

Examples of economical surfacing are shown in Figs. 2 and 3, the former showing grinding of pillow blocks and caps. The 6 in. x 13 in. bottom surface of the cast iron pillow block was formerly done on a variable speed, motor driven shaper, using high speed tools to the limit of their capacity. In order to make this suitable for grinding instead of shaping, the pattern was changed. Very little stock was left for finish, and surface

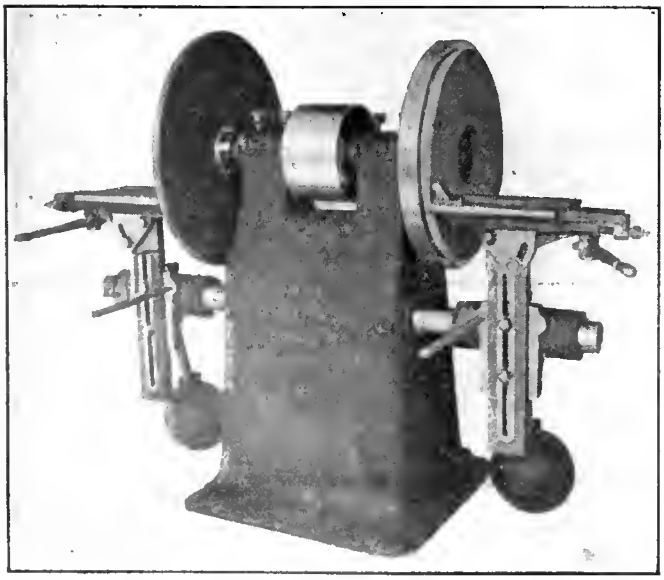


FIG. 1. NO. 17 GRINDER WITH 24-INCH DIAMETER WHEEL.

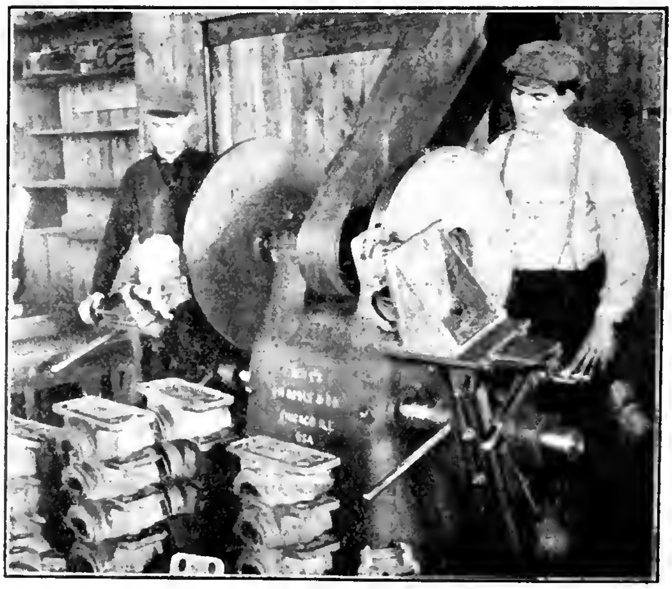


FIG. 2. GRINDING CAST IRON PILLOW BLOCKS AND CAPS.

was recessed in molding to facilitate grinding. By a little care on the part of the moulder, these castings came to the grinder with a maximnm of 1/16 in. stock for finish.

The No. 17 Besly wide face ring wheel grinder roughed and finished these surfaces, to size and flat—tested on surface plate, in less than two minutes. Former time on shaper was about twenty minutes. Allowing for careless moulding, necessitating the removal of ⅛ in. of stock, the grinder accomplishes the work in three minutes as against 20 minutes for the shaper, this time covering all work, floor to floor, including surface plate test. It will be noted that these heavy pillow blocks and caps are ground without rigid chucking—the work "floats" against the grinding wheel both in roughing and finishing operations.

Referring to Fig. 3 which shows grinding of automobile gear shifter covers; these castings are malleable iron and rather frail. As they are ground without rigid chucking, there is no chance to distort the casting as when rigidly clamped for milling.

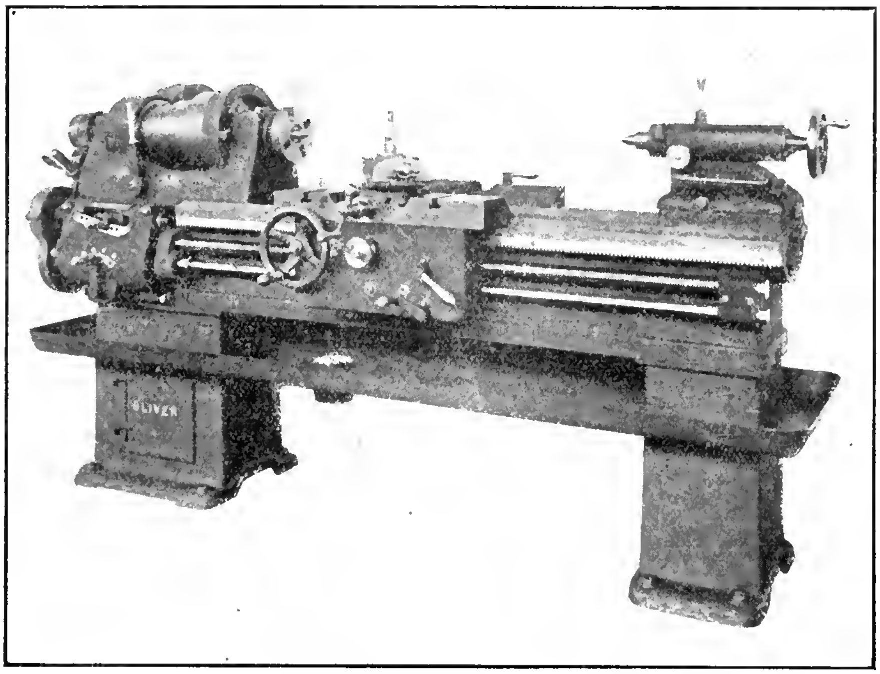
The grinder workholder is very simple. The work rests loosely on three studs projecting from the face of the angle plate. The work is located and supported on this three-point bearing by means of four studs projecting from the angle plate. The time on this job is 200 grinding operations per hour, per operator, or 100 castings roughed and finished per hour, per operator. As machine accommodates two operators, the production per machine is double that above mentioned. The geared lever feed work table used on this Besly grinder gives the operator a leverage of 20 to 1, so that with a very slight pressure of the operator's hand, the work is forced against the grinding wheel with sufficient pressure to secure maximum grinding efficiency.

To secure the best results, it is necessary to use care in designing patternmaking and moulding, so that the work may come to the grinder with the minimum amount of stock for finish, and large surfaces should be relieved to facilitate grinding.

FIG. 3. GRINDING SMALL MALLEABLE IRON CASTINGS.

16 IN. HEAVY DUTY ENGINE LATHE

THE 16-in. "Oliver" engine lathe embodies in its construction a number of new ideas in design. It is built with ample power and is quite rigid for heavy and fast cuts.



16-INCH HEAVY DUTY ENGINE LATHE.

The headstock is of three-step double back-geared type, using 3¾ in. wide belt. The spindle is large in diameter, with long bearings, lubricated by means of felt wipers feeding from large pockets. Spindle is of special high carbon steel accurately ground. The cone pulley is so designed as to carry a large oil reservoir, which provides lubricant at all times. The drive pinions for the back gears are one solid forging made of special high carbon steel and pressed into the cone pulley, keyed on, and reinforced by three filister head screws. A replaceable bronze bushing gives the proper bearing for the spindle in these gears. Thrust is taken against the front end of the rear bearing housing on a hardened and ground steel collar.

The bed is of very liberal proportions, being 7 ft. 2 in. long x 13 in. deep x 15 in. wide, and is strongly reinforced by boxed sections. The supporting columns are so placed as to allow no overhang at the end of the bed, and they are made wide so as to shorten the span of the bed between the columns. Saddle carrying cross slides to the post and apron is unusually heavy and generous in its measurements. It is 7 in. wide at the bridge and a 24½ in. bearing on the shears. Cross slide and compound slide are both provided with taper gibs to take up wear, and both screws for

this slide are indexed to read to .001 inch.

The apron is cast in one piece, and provides a double bearing to all gears.

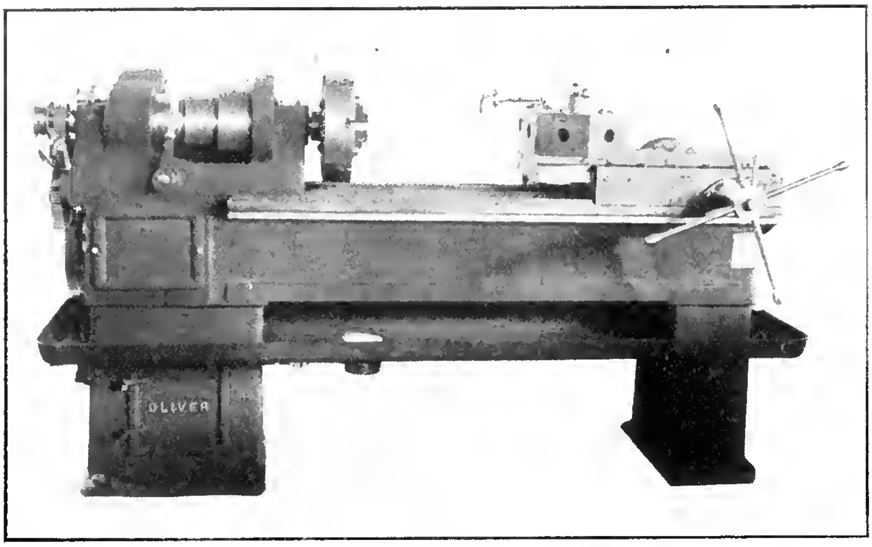
The tailstock spindle is of the same material as the hearstock spindle and accurately ground. Tailstock is clamped to the bed by means of a single heavy cast iron clamp operating the whole length of the tailstock, and secured by two bolts diagonally placed, which provides one of the best methods yet adopted for locking a tailstock. Tailstock casting is not split, but the spindle is locked by means of a clamping lever acting on double nuts, machined to fit perfectly to tailstock spindle.

The gear box for the quick change gears is very compact, requiring only two levers to obtain the thirty-two threads, ranging from three to forty-six per inch. Feeds, thirty-two in number, range from .0076 in. to .111 in. per revolution of spindle. All gears and shafts in the gear box are lubricated from but two oil cups, and there is no multiplicity of oil holes to become clogged with dirt. Gears are all steel machine cut. The gear box is so arranged that part of the box extends into the bed and projection beyond the front of the bed is reduced to a minimum, making a very compact drive. All shafts in the gear box are bronze bushed.

For lathes requiring turret, the tailstock, change gear box, apron and saddle are omitted, and the turret base, slide and turret are placed upon the bed. By means of suitable gearing the turret is connected positively to the spindle, and may be operated by power feed if desired. Change gears supplied with a machine thus equipped, allow four feeds, viz.: .010 in., .012 in., .015 in., .018 in. per revolution of spindle. To change to hand feed it is simply necessary to trip the power feed lever, dropping the worm out of mesh with the worm wheel. The diameter of the turret across the flat is 12 in. The bore for the tools is 2 in., and on each face four holes are tapped to secure special tool holders or other special equipment as desired. The turret head revolves upon a very large stud fitting it exactly, so that it is not necessary to use the clamping lever at each operation unless heavy cuts are being taken. The revolving head is of hexagon shape, giving better results for box tools. By forcing the turret slide back by means of the hand wheel the locking plunger is automatically released and the head revolved to the next station. The turret is self-indexing, the locking plunger being tool steel kept in line with taper gibs and seating itself in a hardened steel ring underneath the turret. The feed shaft is keywayed for 30 in. from the end, permitting the whole turret mechanism to be moved up close to the headstock if it is necessary to machine short work.

The equipment for the turret lathe consists of double friction countershaft, pump and piping and flexible hose with steel chip and drain pan, centre bushing and knock-out plug, and one No. 4 Morse taper centre and all necessary wrenches. (Chuck not included.)

Equipment for the regular engine lathe consists of double friction countershaft, tool post, 7 in. face plate, centre bushing and knock-out plug, pump, piping and flexible hose, steel chip pan, two No. 4 Morse taper centres, and necessary wrenches.



16-INCH LATHE FITTED WITH TURRET.

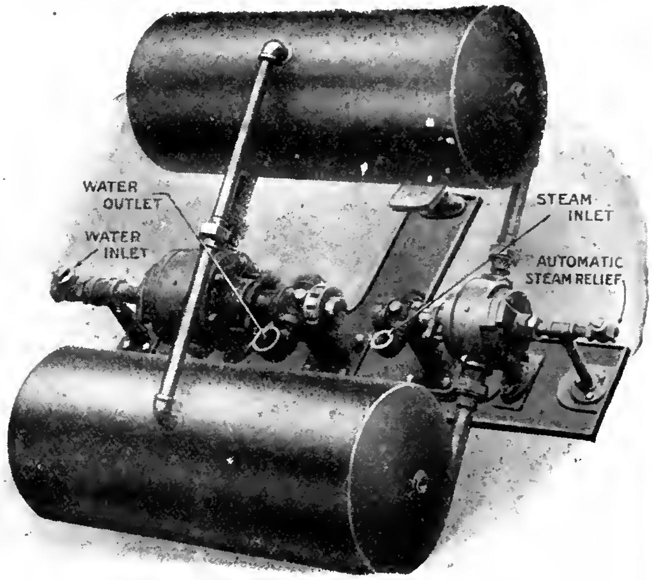
The principal specifications of this lathe, which is the product of the Oliver Machinery Co., Grand Rapids, Mich., are as follows:

Swing-over carriage	$10\frac{1}{4}$ in.
Swing-over shears	$17\frac{1}{2}$ in.
Length of bed	7 ft. 2 in.
Distance between centres	$38\frac{1}{2}$ in.
Front spindle bearing	3 in. x 5 in.
Rear spindle bearing	$2\frac{3}{8}$ in. x $3\frac{3}{4}$ in.
Tailstock spindle diameter	$2\frac{1}{8}$ in.
Tailstock spindle travel	6 in.
Hole through spindle	1 5/16 in.
Countershaft pulleys	12 in x 4 in.
Countershaft speeds	180-220 r.p.m.
Weight on skids	3,150 lbs. net.

DUPLEX STEAM TRAP

THIS Duplex Return Steam Trap is designed to fill all the requirements where a reliable and inexpensive method of handling condensation is necessary. It receives the water of condensation from whatever source and automatically delivers it into the boiler, or elevates it to a heater at practically the temperature corresponding to the pressure at which the steam is condensed.

Self-cleaning valves of the sliding type are used. These are brass-lined and not liable to choke. The device feeds direct from the main or other source, discharging a continuous stream of are used in operating this trap and the



DUPLEX STEAM TRAP AND BOILER FEEDER.

water to the boiler. No levers or weights whole arrangement is located entirely on the exterior of the boiler where all parts are easily accessible.

When one tank is filling the other is emptying, the difference in weight of water in the drums operating the system.

The American Duplex Steam Trap Co. of Detroit, Mich., are the makers of this appliance.

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DEVELOPMENT OF SHELL MAKING OPPORTUNITIES

THE certainty of a prolonged struggle in Europe has practically eliminated all uncertainty regarding developments in Canada's shell industry, and the net result is that we are now on the eve of embarking on the manufacture of types of shells in quantity, size and weight that not only easily surpass our present accomplishment, but call for equipment, methods, devices, attachments, and operative skill more diversified and more highly specialized than has yet been our privilege or opportunity.

The abnormal demand for machine tools and the myriad accessories incidental thereto shows little, if any, abatement so far as the manufacture of 3.3 shrapnel and 3.3 and 4.5 high explosive shells is concerned. In spite of this, and the fact that the placing of orders for these specialties will be continued without intermission and more or less indefinitely, contracts are being let for not only larger type shells, but for quantities of them that may easily rival the prolific production output of the above-mentioned small size projectiles.

Our editor has just returned from Ottawa, where he was privileged to meet Messrs. W. L. Hichens and R. H. Brand, who recently arrived from England to assume expert representation of the British Minister of Munitions on our Shell Committee.

Advantage was taken of the opportunity while in Ottawa to discuss a few features of the munitions situation in Canada and Great Britain at the present time, and relative to the easily unparalleled conditions that must necessarily be faced by both countries on conclusion of the war. The matter of ordnance manufacture in Canada also came under review.

Although but a few days in Canada, Messrs. Hichens and Brand had got well into harness, and, while the former was more or less a stranger in our midst, it was early apparent in the course of conversation that Mr. Brand was neither a stranger in the geographical sense of the word, nor in a business sense. Considering, however, the importance of the mission of the two gentlemen, it was by no means surprising that a widespread intimacy of men and things Canadian revealed itself.

Appreciation of the shell production of our metal-working plants, large and small, was expressed. Labor conditions were also touched upon, the employment of female labor on an extensive scale by munitions firms in Britain being referred to as the only solution there for the shortage of male labor, so far as maintenance and continuity of output was concerned.

Regarding the position of factories both here and in Great Britain when peace is declared, there was a tendency evident to presuppose a possibly brief but trying period during which the readjustments to peace conditions were being made. It was, however, anticipated that a gradual slowing down of munitions production would be operative through the better part of the succeeding twelve months, and that in the case of the specially-built and equipped "National" factories in Great Britain, these would be promptly closed down.

In the matter of the establishment of a Canadian ordnance factory, the consensus of opinion favored same, it being believed that, despite the lapse of time necessary to construct, equip and bring to the production stage such a plant, the venture would be worth while from the present war point of view, and would be an asset of considerable value to us against future war possibilities.

The addition to the personnel of Canada's Shell Committee of W. L. Hichens and R. H. Brand gives unmistakable proof of whole-hearted intention on the part of Britain's Munitions of War Minister to not only follow up the achievement of the Shell Committee formed by our Minister of Militia, but to strengthen, develop and broaden the scope by enlarging the opportunity of that body, and through it make our metal working plants more patriotically and commercially effective.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey forge, Pittsburgh	$15 20
Lake Superior, charcoal, Chicago	16 75
Ferro Nickel pig iron (Soo)	25 00

	Montreal.	Toronto.
Middlesboro, No. 3	$24 00	.....
Carron, special	25 00	.....
Carron, soft	25 00	.....
Cleveland, No. 3	24 00	.....
Clarence, No. 3	24 50	.....
Glengarnock	28 00	.....
Summerlee, No. 1	30 00	.....
Summerlee, No. 3	29 00	.....
Michigan charcoal iron.	28 00	.....
Victoria, No. 1	24 00	21 00
Victoria, No. 2X	23 00	21 00
Victoria, No. 2 plain..	23 00	21 00
Hamilton, No. 1.......	23 00	21 00
Hamilton, No. 2	23 00	21 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto..	2.35
Steel bars, f.o.b., Toronto.........	2.45
Common bar iron, f.o.b., Montreal	2.35
Steel bars, f.o.g., Montreal	2.45
Twisted reinforcing bars	2.35
Bessemer rails, heavy, at mill....	1.25
Steel bars, Pittsburgh	1.60
Tank plates, Pittsburgh	1.60
Beams and angles, Pittsburgh....	1.60
Steel hoops, Pittsburgh	1.75
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.40
Small shapes	2.65
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	2.25
Structural shapes	2.50
Plates	2.30

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ¼ to ½ in., 100 lb.	$2 35	$2 35
Heads, per 100 lb.	2 60	2 60
Tank plates, 3-16 in.	2 70	2 70

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$12 25	$12 25
Copper, crucible	14 25	14 00
Copper, unch-bled, heavy	14 25	13 50
Copper, wire, unch-bled..	14 25	14 00
No. 1 machine compos'n	11 50	11 50
No. 1 compos'n turnings	10 25	10 00
No. 1 wrought iron	10 00	8 50
Heavy melting steel	8 50	8 50
No. 1 machin'y cast iron	13 50	12 50
New brass clippings....	11 00	11 00
No. 1 brass turnings....	9 00	9 00
Heavy lead	4 60	4 50
Tea lead	$ 3 75	$ 3 50
Scrap zinc	11 50	10 00

W. I. PIPE DISCOUNTS.

Following are Toronto jobbers' discounts on pipe in effect Aug. 27, 1915:

	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
Standard				
¼, ⅜ in.	63	38½	....	....
½ in.	68	47½	....	....
¾ to 1½ in. ..	73	52½	....	....
2 in	73	52½	69	48½
2½ to 4 in ...	73	52½	72	51½
4½, 5, 6 in...	....	....	70	49½
7, 8, 10 in. ...	....	....	67	44½
X Strong P. E.				
¼, ⅜ in.	56	38½	....	....
½ in.	63	45½	....	....
¾ to 1½ in. ..	67	49½	....	....
2, 2½, 3 in. ..	68	50½	....	....
2 in.	....	....	63	45½
2½ to 4 in. ..	....	....	63	48½
4½, 5, 6 in. ..	....	....	66	48½
7, 8 in.	....	....	59	39½
XX Strong P. E.				
½ to 2 in.	44	26½	....	....
2½ to 6 in. ...	....	....	43	25½
7 to 8 in.	....	....	40	20½
Genuine Wrot Iron.				
⅜ in.	57	32½	....	....
½ in.	62	41½	....	....
¾ to 1½ in. ..	67	46½	....	....
2 in.	67	46½	63	42½
2½, 3 in.	67	46½	66	45½
3½, 4 in.	....	....	66	45½
4½, 5, 6 in. ..	....	....	63	42½
7, 8 in.	....	....	60	37½

Wrought Nipples.

4 in. and under	77½%
4½ in. and larger	72½%
4 in. and under, running thread.	57½%

Standard Couplings.

4 in. and under	60%
4½ in. and larger	40%

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65 & 5%
Sq. Head Set Screws	70 & 5%
Rd. & Fil. Head Cap Screws......	45%
Flat & But. Head Cap Screws....	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in. N.	70%
Semi-Fin. Nuts up to 1 in.	70%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

METALS.

	Montreal.	Toronto
Lake copper, carload ...	$20 00	$19 50
Electrolytic copper	20 00	19 25
Castings, copper	19 25	19 00
Tin	38 00	40 00
Spelter	18 00	18 00
Lead	6 50	6 50
Antimony	35 00	35 00
Aluminum	60 00	60 00

Prices per 100 lbs.

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh...	$26 00
Open-hearth billets, Pittsburgh..	28 00
Forging billets, Pittsburgh	45 00
Wire rods, Pittsburgh	33 00

NAILS AND SPIKES.

Standard steel wire nails, base	$2 60	$2 55
Cut nails	2 50	2 70
Miscellaneous wire nails..	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	70-10
Stove bolts	80
Plate washers....................	40
Machine bolts, ⅜ and less......	65-10
Machine bolts, 7-16 and over	57½
Blank bolts	57½
Bolt ends	57½
Machine screws, iron, brass.....	35
Nuts, square, all sizes....4c per lb. off	
Nuts, hexagon, all sizes..4½c per lb. off	
Iron rivets	72½
Boiler rivets, base, ¾-in. and larger	$3.75
Structural rivets, as above	3.75
Wood screws, flathead, bright ....85, 10, 7½, 10 p.c. off	
Wood screws, flathead, Brass ....75 p.c. off	
Wood screws, flathead, Bronze ....70 p.c. off	

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Standard. Price. per ft.	Extra Strong. Sizes Ins.	Extra Strong. Price per ft.	D. Ex. Strong. Size Ins.	D. Ex. Strong. Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.....
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....

COKE AND COAL.

Solvay Foundry Coke	$6.25
Connellsville Foundry Coke	5.65
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

COLD DRAWN STEEL SHAFTING.

At mill	35%
At warehouse	30%

Discounts off new list. Warehouse price at Montreal and Toronto.

MISCELLANEOUS.

Solder, half-and-half	0.23
Putty, 100-lb. drums	2.70
Red dry lead, 100-lb. kegs, per cwt.	9.65
Glue, French medal, per lb.	0.15
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.23
Benzine, single bbls., per gal.	0.25½
Pure turpentine, single bbls.	0.80
Linseed oil, raw, single bbls.	0.77
Linseed oil, boiled, single bbls.	0.80
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.50
Lead Wool, per lb.	0.11
Pure Manila rope	0.16
Transmission rope, Manila	0.20
Drilling cables, Manila	0.17
Lard oil, per gal.	0.73
Union thread cutting oil	0.60
Imperial quenching oil	0.35

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto 40%

PROOF COIL CHAIN.

¼ in.	$9.00
5-16 in.	5.90
⅜ in.	4.95
7-16 in.	4.65
½ in.	4.40
9-16 in.	4.05
⅝ in.	4.30
¾ in.	4.15
⅞ inch	3.65
1 inch	3.45

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	55
Carbon over 1½ in.	25
High Speed	
Blacksmith	55
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Centre	25
Pipe Reamers	80

Discounts off standard list.

IRON PIPE FITTINGS.

Canadian malleable, A, 25 per cent.; B and C, 35 per cent.; cast iron, 60; standard bushings, 60 per cent.; headers, 60; flanged unions, 60; malleable bushings, 60; nipples, 75; malleable, lipped unions, 65.

TAPES.

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic. 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3.50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$3 00	$2 85
Canada plates, dull, 52 sheets	3 15	3 15
Canada Plates, all bright	4 60	4 75
Apollo brand, 10¾ oz. galvanized	5 50	4 80
Queen's Head, 28 B.W.G.	6 00	5 95
Fleur-de-Lis, 28 B. W. G.	5 75	5 75
Gorbal's Best, No. 28	6 00	6 00
Viking metal, No. 28	5 25	5 25
Colborne Crown, No. 28	5 70	5 80
Premier No. 28	5 40	5 20

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$14 25	....
1¼ in.	14 25	....
1½ in.	14 25	....
1¾ in.	14 25	....
2 in.	14 25	9 25
2¼ in.	15 50	10 50
2½ in.	16 50	11 50
3 in.	21 00	12 25
3½ in.	24 00	14 50
4 in.	29 50	18 50

Prices per 100 feet, Montreal and Toronto.

WASTE.

WHITE.	Cents per lb.
XXX Extra	0 11½
X Grand	0 11
XLCR	0 10¼
X Empire	0 09½
X Press	0 08¾
COLORED.	
Lion	0 07¾
Standard	0 07
Popular	0 06¼
Keen	0 05½
WOOL PACKING.	
Arrow	0 17
Axle	0 12
Anvil	0 09
Anchor	0 07
WASHED WIPERS.	
Select White	0 08½
Mixed Colored	0 06¼
Dark Colored	0 05¼

This list subject to trade discount for quantity.

BELTING RUBBER.

Standard	50%
Best grades	30%

BELTING—NO. 1 OAK TANNED.

Extra heavy, single and d'ble,	40 & 10%
Standard	50%
Cut leather lacing, No. 1	$1.20
Leather in sides	1.10

ELECTRIC WELD COIL CHAIN B.B.

⅛ in.	$12.75
3-16 in.	9.00
¼ in.	6.00
5-16 in.	4.75
⅜ in.	3.75
7-16 in.	3.75
½ in.	3.75
⅝ in.	3.60
¾ in.	3.60

Prices per 100 lbs.

PLATING CHEMICALS.

Acid, boracic	$ .15
Acid, hydrochloric	.05
Acid, hydrofluoric	.06
Acid, Nitric	.10
Acid, sulphuric	.05
Ammonia, aqua	.08
Ammonium carbonate	.15
Ammonium chloride	.11
Ammonium hydrosulphuret	.35
Ammonium sulphate	.07
Arsenic, white	.10
Copper sulphate	.10
Cobalt Sulphate	.50
Iron perchloride	.20
Lead acetate	.16
Nickel ammonium sulphate	.10
Nickel carbonate	.50
Nickel sulphate	.15
Potassium carbonate	.40
Potassium sulphide (substitute)	.20
Silver chloride (per oz.)	.65
Silver nitrate (per oz.)	.45
Sodium bisulphite	.10
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.35
Sodium hydrate	.04
Sodium hyposulphite (per 100 lbs.)	3.00
Sodium phosphate	.14
Tin chloride	.45
Zinc chloride	.20
Zinc sulphate	.07

Prices Per Lb. Unless Otherwise Stated.

ANODES.

Nickel	.47 to .52
Cobalt	1.75 to 2.00
Copper	.22 to .25
Tin	.45 to .50
Silver	.55 to .60
Zinc	.22 to .25

Prices Per Lb.

PLATING SUPPLIES.

Polishing wheels, felt	1.50 to 1.75
Polishing wheels, bullneck	.80
Emery in kegs	.4½ to .06
Pumice, ground	.05
Emery glue	.15 to .20
Tripoli composition	.04 to .06
Crocus composition	.04 to .06
Emery composition	.05 to .07
Rouge, silver	.25 to .50
Rouge, nickel and brass	.15 to .25

Prices Per Lb.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., Nov. 8, 1915.—The general industrial situation still shows an improving tendency. While the bulk of the business is largely due to the filling of contracts for munitions and war supplies, considerable activity is being shown in other spheres of industrial enterprise.

Several plants, closely connected with shell-making in and around Montreal, are contemplating building additions to their present factories, or erecting new plants entirely to meet the requirements of the newly-placed orders. It is understood that the Canada Cement Company have commenced operations on a plant which, when completed, will be fully equipped with the necessary machinery for the production of 9.2 high explosive shells.

The successful harvesting of an unprecedented crop will go a long way to stimulate trade conditions in Canada. The transportation of the crop is expected to tax to the limit existing facilities and equipment, both on land and water.

Pig Iron

Reports from many sources show conditions steadily improving in the market for pig iron. For some time there was apparent the possibility of a shortage in the supply, due to the heavy demand for steel bars and billets. Production has, however, been well maintained, the pace set by the unprecedented output requirements of the steel mills notwithstanding. While advances fail to be noted in the quotations of foreign markets, local prices remain steady. Increased demand in the near future, due to the requirements of shell manufacturers, for the production of larger shells may cause a further advance and tend to create a scarcity.

If the production of pig iron becomes in excess of the quantity consumed, no serious inconvenience will be caused.

Steel

The exceptional situation in the iron and steel trade has a tendency to put the general markets somewhat out of balance. No definite prices can be obtained on many steel products, as many of the mills have withdrawn quotations. In numerous instances it is not a question of price, but of output, as the mills are full up with orders that will keep them busy at full capacity for a period of six months to a year or more. The advent of further orders for 3.3 and 4.5 shells and the placing of contracts for the larger high explosive shells will, of course, make the situation still more acute.

Purchasers of finished steel are having great difficulty in securing early delivery, and in some cases it is only the largest buyers that are getting any reasonable satisfaction on their manufacturing needs for 1916. Some concerns may find their future output seriously curtailed for lack of raw material.

Machine Tools and Supplies

Machine tool builders are having added responsibility placed upon them by the inquiries for equipment for the production of 5-in., 6-in., 8-in. and 9.2-in shells. No definite information is available as to the firms receiving orders for these munitions, but it is learned that several of the largest plants throughout the Eastern provinces have signed contracts for shell orders amounting to anywhere from $5,000,000 to $25,000,000. With the completion of the placing of these contracts and further orders for the smaller shells, the demand for tools is bound to tax the resources of machine tool makers to the utmost. The equipment necessary for the larger size shells will require very heavy machinery and facilities for handling will require careful consideration on the part of the tool builder and the shell manufacturer.

The 9.2-in. and 8-in. shells, and even the 6-in. shells, will necessarily require different equipment than that being used for the smaller and lighter projectiles. Convenient and economic methods must be adopted for handling the heavy shells in and out of the different machines and transferring them from opeeration to operation. Chain blocks, air hoists and monorails or transfer trucks will be required, and means of holding the shells and driving them while being turned will call for special thought and consideration. Inquiries have been received by one dealer for 35 large projectile lathes for the manufacture of 9.2-in. shells.

ALLIES PURCHASING AGENTS

The Trade and Commerce Department, Ottawa, has published the following list of purchasing agents for military purposes for the allied Governments:

International Purchasing Commission, India House, Kingsway, London, Eng.

French.—Hudson Bay Co., 56 McGill Street, Montreal; Captain Lafoulloux, Hotel Brevort, New York; Direction de l'Intendence Ministere de la Guerre, Bordeaux, France; M. De la Chaume, 28 Broadway, Westminster, London.

Russian.—Messrs. S. Ruperti and Alexsieff, care Military Atache, Russian Embassy, Washington, D.C.

Metals

The general trend of the metal markets is to advance, and while quotations remain unchanged locally, there is a possibility of slight advances in some lines before the close of the present week. Lead will very likely be stronger. New York quotes the following advances:—Spelter, .75 cents; lead, .15 cents; tin, 2.32 cents, and antimony, 1.25 cents per pound.

Copper

Slight improvement is shown in the copper market, but owing to the comparatively poor showing of last month, producers are still in a position to supply the demand without noticeable advance in prices. Requirements of copper for shell orders now being placed may have some effect towards increasing prices.

Tin

While activity in the foreign markets appears brisk, the local situation is little changed from the previous week, and quotations are holding firm. An advance of 2.32 cents per lb. is shown on the New York market, due to the apparent scarcity of supply. Local dealers are quoting 38c per pound.

Spelter

A decline in the price of spelter is looked for in the near future. Producers are gradually increasing the supply over that of the demand, and prospects are that quotations on spelter will be lower than at present. Foreign demand has created an advance in the United States, but there is little to indicate what the ultimate condition of the market will be. The price is steady at 18 cents per lb.

Lead

Quotations on lead remain firm, and the situation is unchanged. However, local dealers expect an advance before the coming week. Present price, 6½ cents a lb.

Antimony

The market is quiet, but quotations remain firm, present price being 35 cents per lb.

Old Material

Business is quiet with dealers in old material. Inquiries for heavy melting steel and turnings have fallen off considerably. Prices remain unchanged,

with the exception of tea lead, which shows an advance of 25 cents per 100 lbs,. and scrap zinc; which has risen to $11.50 per 100 lbs.

Toronto, Ont., Nov. 9.—The industrial situation continues favorable and there is an increase of confidence for the future in business circles. In addition to heavy increases in exports the Dominion revenue is steadily growing. The customs returns for October were about four million dollars more than for the corresponding month of 1914, while for the first seven months of the present fiscal year the revenues were seven millions more than for the corresponding period of last year. The high ocean freight rates at present prevailing are a serious handicap to ordinary trade other than war business. The rates which are very much higher than at normal times, add considerably to the cost of the product and so have a tendency to restrict business.

Developments in the shell industry are being followed with the greatest interest; this is to be expected, considering the large amount of money involved. Contracts for the 6-in., 8-in. and 9.2-in. shells are being allotted gradually, and it is pretty well understood who are the recipients, although the amounts and values have not been given out officially. A large number of tenders for shells and shell parts have been submitted and their consideration requires considerable time and attention. The reorganization of the Shell Committee will probably not take place until the awarding of the various contracts has been completed. Sir Frederick Donaldson has left for England, where he will report to the War Office as to conditions in Canada and the feasibility of establishing ordnance works here.

Steel Market

The most important development in the steel market this week and one which indicates the trend of business is the withdrawal of prices on steel bars. The mills have taken this action on account of the unsettled condition of the market due to the heavy demand for steel and the difficulty in promising delivery. The mills will until further notice quote on application only for prompt acceptance. Canadian steel companies have advanced steel bars 10c. to $2.45 per 100 lbs., which price is really nominal. Iron bars are unchanged at $2.35. Pittsburgh bars for Canadian consumption are quoted nominally at 1.50c, but higher prices are more general. The steel market is very active and the demand for steel for munitions is steadily increasing. The placing of orders for the large-calibre shells will mean a considerable increase in tonnage, and will tax the capacity of the mills. This business will be additional to the requirements for the 18-pdr. shells, which are still being produced in large quantities. The steel trade is in an exceedingly prosperous condition and the present activity will no doubt be a permanent benefit to the industry.

Prices of electric weld coil chain have been reduced, but in all probability will only be effective a short time. With a higher tendency on all steel products, chain cannot help but be effected. Proof coil chain, fire welded, is unchanged but an advance is looked for in the near future. Seamless boiler tubes are very firm at last week's advance and may go still higher. Prices of boiler plates have been readjusted in an upward direction. Galvanized sheets are strong, some brands having been advanced. The tendency is decidedly in an upward direction on account of the high prices of spelter, acid and black sheets. There is only a fair demand for galvanized sheets in Canada, although in the States there is a large volume of export business. Bessemer black sheets No. 28 gauge are being quoted at 2.10c to 2.20c; open hearth; No. 28, 2.20c to 2.24c, and blue annealed No. 10 at 1.70c to 1.80c, Pittsburgh. "Premier" galvanized sheets are now being quoted at $5.20 per 100 lb. Toronto.

CANADIAN GOVERNMENT PURCHASING COMMISSION

The following gentlemen constitute the Commission appointed to make all purchases under the Dominion $100,000,000 war appropriation:—George F. Galt, Winnipeg; Hormidas Laporte, Montreal; A. E. Kemp, Toronto. Thomas Hilliard is secretary, and the commission headquarters are at Ottawa.

The high-speed tool steel situation may fairly be said to be acute. The scarcity, especially under present conditions, is very serious and is causing considerable anxiety to makers of munitions. Although prices are advancing all the time, these ranging from $2.50 to $3.50 per lb., the makers are unable to promise either a definite delivery date or the amount specified. Stocks in Canada are very low and supplies are difficult to obtain from Sheffield, England, on account of the restrictions placed on exports of tool steel by the British Government because of the enormous demand and the necessity of conserving supplies. The heavy demand in the States also makes it exceedingly difficult to obtain supplies from the mills in that country.

The extraordinary demand in the States for steel, particularly for munitions, continues and the mills are overwhelmed with orders. The output is expanding rapidly and prices are steadily advancing. For domestic delivery all makers are quoting bars at 1.50c Pittsburgh, but export business is being booked at considerably higher figures. The heavy demand for billets continues and prices are still advancing. Bessemer billets are now being quoted at $26, open-hearth billets at $28, and forging billets range from $35 to $45 f.o.b. Pittsburgh.

Pig Iron

There is an increased demand for low-phosphorus pig iron and there appears to be some scarcity of this grade. It is reported that Canadian buyers are unable to satisfy their requirements, one interest being in the market for several thousand tons monthly. Foundry grades are in better demand, but the tonnage is comparatively light.

Machine Tools

Although it is understood that no contracts for the large shells have been signed up, a number of firms who are practically certain of getting some of the business are making preparations to this end. Enquiries have been sent out for heavy lathes, but few orders have actually been placed, although considerable activity is expected very shortly. The situation is interesting to local dealers, and also to the builders of suitable tools.

Supplies

The demand for machine shop supplies continues very active, and prices in some lines have advanced. An all-round advance in cotton and wool waste has been announced ranging from ¼c to 1c per pound according to quality, etc. The long expected advance in leather belting has materialized, the new discounts being 40 and 10 per cent. for extra heavy single and double, and 50 per cent. for standard quality. Prices of high-speed cutters are higher, and the list has been revised with extras added. Prices on high-speed twist drills are withdrawn and quotations made only for prompt acceptance. Benzine has advanced again, and is now quoted at 25½c per gallon in barrels. Gasoline is 3c higher and is quoted at 23c per gallon. There is practically no change in prices of linseed oil or turpentine, although the latter is subject to considerable fluctuation and ranges from 76c to 82c per gallon. Plumbers' oakum is a little higher, and is quoted at $4.50 per 100 lb.

Old Metals

The metal for scrap iron and steel is weaker, Canadian mills having covered their requirements meantime. No. 1 wrought iron and heavy melting steel are both lower, having dropped 50c a ton. Machinery cast iron is stronger and has advanced 50c per ton. The market

(Continued on page 46.)

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Niagara Falls, Ont.—W. P. Gonder is in the market for turning machinery to cost $1,000.

Woodstock, Ont.—W. Baird & Son will build a machine shop to cost $4,000.

London, Ont.—The Empire Brass Co. will build an addition to their plant, to cost $1,300.

Montreal, Que.—The Canadian Tube & Iron Co. is building a machine shop on St. Patrick street.

Niagara Falls, Ont.—J. E. Gardner is in the market for a 20 h.p. engine and boiler to operate a sawmill.

Montreal, Que.—A fire at the Canadian Steel Foundries plant on St. Patrick street did about $1,500 damage on Nov. 2.

Owen Sound, Ont.—The Canadian Malleable Iron Co. will equip its plant for the manufacture of 60-lb. high-explosive shells.

Owen Sound, Ont.—The Owen Sound Iron Works Co. will shortly install machinery in its plant to manufacture high-explosive shells.

Mount Brydges, Ont.—R. H. Bellamy, Box 134, will purchase material for the factory to be erected here for the Crow Automobile Co.

Eustis, Que.—The Eustis Mining Co. will extend their plant at a cost of $100,000. Loomis & Dakin Co., Montreal, are the contractors.

Victoria, B.C.—The Victoria Chemical Co. will commence shortly on the erection of an addition to its plant for the manufacture of war material.

Leamington, Ont.—The town council have decided to call for tenders for two 110 h.p. boilers for the waterworks. A new boiler house will be built.

Chatham, Ont.—J. D. Dort of Flint, Mich., is associated with Robert Gray of this city in a proposition to establish a factory here for building motor cars.

Toronto, Ont.—It is announced that the Canadian Tygard Engine, Ltd., has purchased the old Ontario House, 942 Kingston road, for a factory, where aeroplane and submarine engines may be manufactured.

Sherbrooke, Que. — The Canadian Ingersoll Rand Co. will build a new machine shop to cost $50,000. Anglins, Ltd., Montreal, are the general contractors.

Vancouver, B. C.—An Eastern firm with a rolling mill costing from $120,000 to $160,000, is looking for a location at the coast, according to City Industrial Commissioner Davison.

Renfrew, Ont.—The O'Brien Munitions, Ltd., are building a smokeless powder plant of a capacity of 35,000 pounds per day. The plant will be opened about the first of the year.

Collingwood, Ont. — The Imperial Steel and Wire Co. is reported to have contracted with the British War Office for a supply of munitions and special articles used in trench warfare, the contract price being close to $5,000,000.

Chatham, Ont.—A deal has been closed whereby the American Well Works Co., of Aurora, Ill., will purchase the old Defiance Iron Works plant in Chatham. The plant was turned over to the new owners for $12,000. They will manufacture waterworks equipment.

Toronto, Ont.—The Canadian Tygard Engine, Ltd., has concluded the purchase of a tract of land at the corner of Kingston road and Lawlor avenue, East Toronto. The present buildings are to be utilized as a factory to fill orders until other buildings can be added.

Electrical

Stratford, Ont.—The Hydro Commission may install more transformers as the existing units are carrying a capacity load.

Kingston, Ont.—B. R. Newton, of Arden, situated about 50 miles from here, has water power capable of developing 2,000 h.p. which it is suggested should be taken over by the city and a hydro electric system installed.

Owen Sound, Ont.—The high tension work at the hydro-electric sub-station here is almost finished, and the current from the Eugenia Falls power plant could be turned on in Owen Sound if necessary. The wires which bring the power from Eugenia into Owen Sound at 22,000 volts have all been connected with the transformers which step it down to 2,300 volts.

Niagara, Falls, Ont.—The ratepayers on Nov. 3, at a special election passed a by-law approving a contract with the Hydro-Electric Commission of Ontario. The by-law was carried by a majority of 48. Another by-law appropriating $14,000 for machinery for the municipal electric light plant was carried by a majority of two. The Hydro contract calls for a minimum of 2,000 horse-power at $11.50 per horse-power, with an additional $1 per horse-power for transmission, and the term is 30 years.

General Industrial

London, Ont.—H. T. Reason contemplates the erection of a factory for the manufacture of paper boxes.

Kingston, Ont.—The City Council may buy a combination motor-driven pump, chemical and hose truck.

Peterborough, Ont.—Fire damaged the plant and stock of the Canadian Chicle Co. on Nov. 1, to extent of $6,000.

Oshawa, Ont.—The council will appoint a town engineer and waterworks superintendent. Thos. Morris is town clerk.

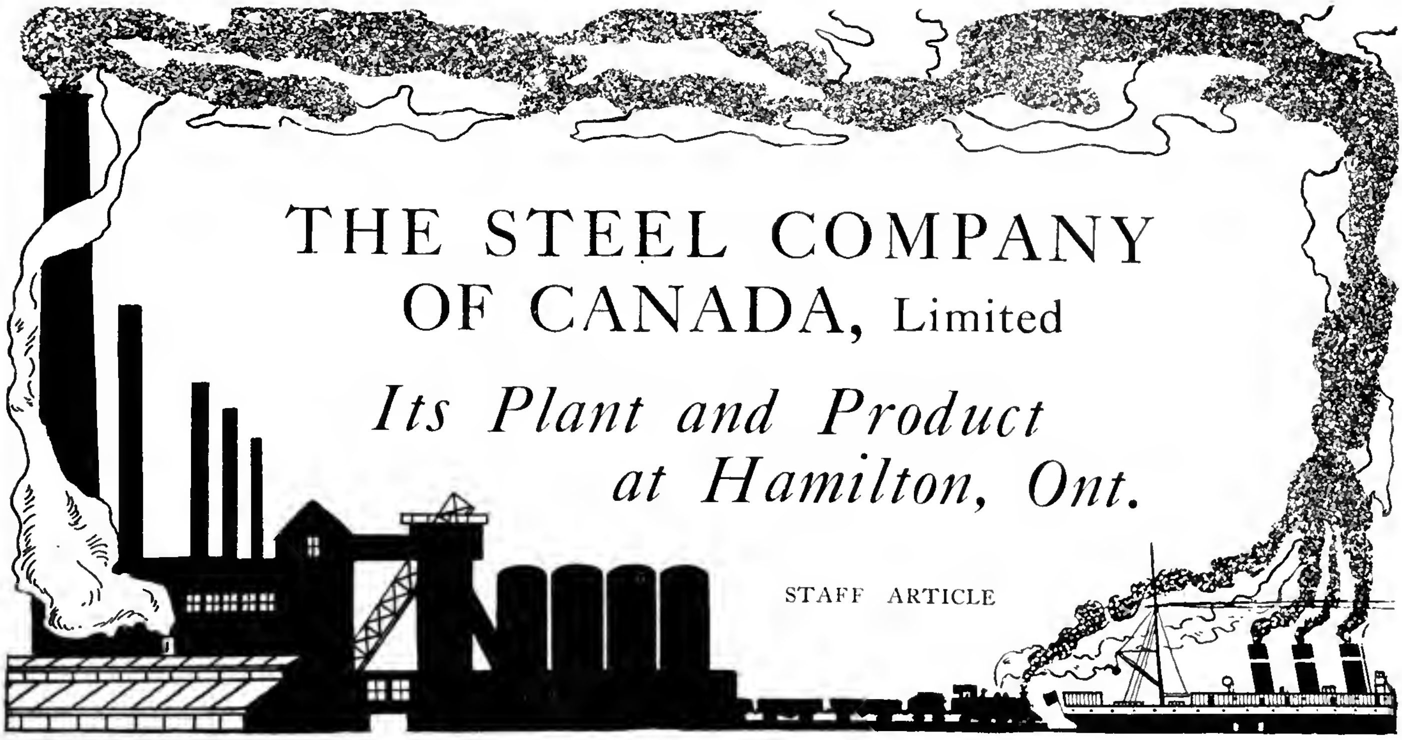
Paris, Ont.—The Paris Wincey Mills Co. will build a factory to cost $30,000. P. H. Secord & Sons, Brantford, are the contractors.

Prescott, Ont.—The Newell Mfg. Co. of Ogdensburg, N.Y., manufacturers of hardware, propose establishing a plant here. A by-law will be submitted to the ratepayers on Nov. 15.

Montreal, Que.—The Canadian Consolidated Rubber Co., Notre Dame Street, are building an extension to their factory to cost $3,000. G. M. Martin & Co. are the general contractors.

Wingham, Ont.—A representative of an American Safe Manufacturing Co. was in town last week looking through the old chair factory with a view to buying. He was greatly impressed with the town.

Windsor, Ont.—The representative of a large New England firm was in Windsor recently seeking a location for a branch plant. The company is anxious to find a building with 15,000 to 20,000 square feet of floor space, preferring rented quarters for the present.



THE STEEL COMPANY OF CANADA, Limited

Its Plant and Product at Hamilton, Ont.

STAFF ARTICLE

From the ore mines of Mesabi to the fighting front in France is a long way to go, but not long enough to prevent a steady flow of shells and other munitions of war. The help which Canada is giving to the Empire, grows in volume and variety as it progresses Eastward and the valued assistance being rendered by establishments such as the one described in this article is convincing evidence of Canada's present power and future potentiality.

THE entrance of Canada into the ranks of munitions producing nations was one of the unexpected events of a war, in which the unexpected has been more than once prominent. A year ago, when hostilities had been in progress for several months, there were few, if any, indeed, who foresaw the extent to which this country's resources would be relied upon for providing not only ammunition, but army stores of all descriptions in enormous quantities. Possessing an area of 3,817,000 square miles, equal to more than one-quarter of the land possessions of the Empire, with natural resources more varied and extensive than any other colony, and geographical location and political environment of the most favorable nature, Canada would have failed in her duty as a loyal colony had she exerted herself one whit less strenuously than she has done during the past year. Circumstances point to intensification and continuation of such efforts till the British Empire once more asserts itself as the chief factor in the world's peace, and in the attainment of such a state of affairs Canada will be looked to for increased help and support until the much desired consummation of events is attained.

The building of ordnance in the near future along with impending developments in munitions manufacture will tend more and more towards the consolidation of the Dominion as a self-contained and fully developed unit, and increase to a desirable extent the effective help so necessary in the terrible struggle for liberty and justice.

The Genesis of a Shell

While the successful production of guns will form the completion of Canada's military development, the demand for munitions has been most urgent, and so far the efforts of all parties have been so concentrated on actual production that few of us have realized that every step, every operation, every substance that enters into a finished shell, and last, but not least, the men and the guns to use them; in fact, each and every phase in the life of a shell from the ore mine to the battlefield is now in existence in this country.

The successful production of a modern artillery projectile is dependent on a degree of scientific knowledge, mechanical ability, and complexity of operations, of which the casual observer has only the faintest idea, and in devoting its efforts to the manufacture of munitions The Steel Company of Canada affords a splendid instance of that promptness, thoroughness and wholeheartedness which has been so characteristic of our manufacturers.

Immediately it became apparent that the company's services would be needed, preparations for new, and alterations to operating plant and equipment were begun and carried out with such promptness and alacrity that in a very short time, shells were being produced at a highly creditable rate, and during the months which the plant has been engaged on this work the company has earned a lasting reputation as a producer of material for this purpose of the very highest order. In considering this performance one must remember that the metal is made from the ore, the forging is made from the metal, and the finished shell produced from the forging all under the one management. The life story of a shell as observed at the company's various plants is fascinating, instructive and highly stimulative of that industrial patriotism which is so characteristic of Canada's present efforts.

Mining the Iron Ore

Situated in the Mesabi range of hills in the northern part of the State of Minnesota, close to the Canadian border, and 800 miles from Hamilton, Ont., as the crow flies, are vast deposits of iron ore. From this locality, known as the Lake Superior district, about 40,000,000 tons of hematite iron ore are shipped annually to blast fur-

naces which yield more than three-quarters of the pig iron production on the North American continent. This red or brown hematite is one of the richest forms of iron ore, containing in some cases as much as 68 per cent. of iron, and in appearance resembles soft brownish earth. The deposits of the Mesabi range of hills lie near the surface, and are mined by means of immense steam shovels or excavators, such as are used for digging foundations, canals, railway cuttings, etc. These deposits are particularly adapted for handling by machinery, and the mining, transportation, and unloading of this material have resulted in the perfection of mechanical appliances of wonderful capacity and efficiency.

Lake Transportation

Ore boats carrying 10,000 or 12,000 tons of ore in one cargo, convey the ore to its destination. These boats are loaded from immense bins, into which the cars from the mines are emptied, the bins being elevated above the level of the boats, so that by means of ore chutes leading into each hatchway, the ore is rapidly conveyed by gravity into the hold of the vessel. In a few hours the ship has received its cargo and is ready to start on its long journey down the chain of inland lakes to its destination, where unloading of the boats is accomplished almost as rapidly as the loading.

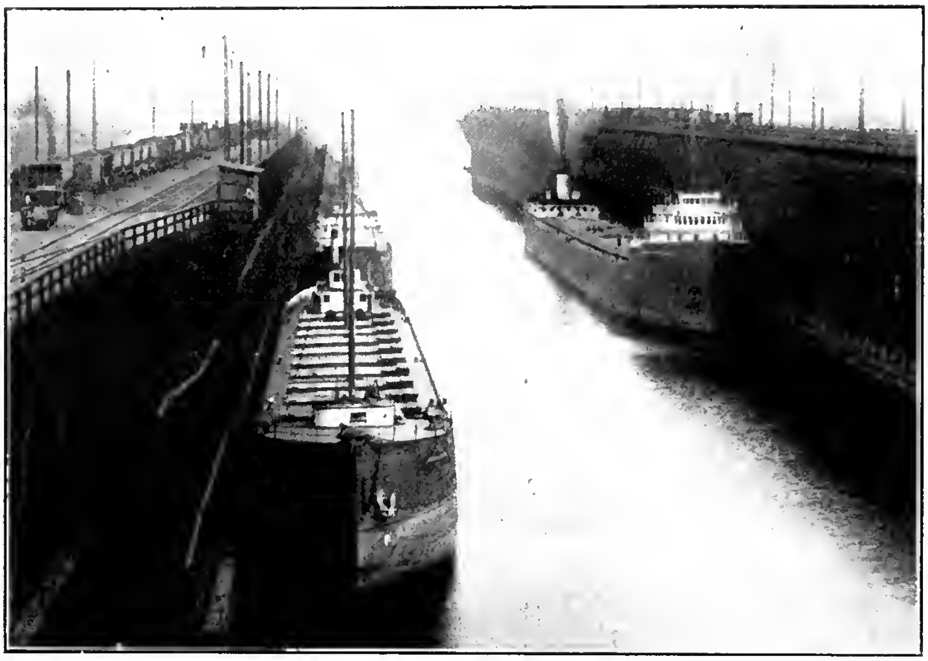


Photo. LOADING ORE BOATS AT MESABA ORE DOCK, DULUTH. Gallagher, Duluth.

The Production of Pig Iron

The plant of The Steel Company of Canada is complete in every detail, and is considered by many authorities to be of most modern design and construction. Here, in an extent of several acres, and in the course of a few hours may be seen steel in every stage of production from iron ore, barely distinguishable from common earth to the shrapnel and high-explosive shell, wanting only the addition of the explosive charge and propellant to make it ready for actual use in battle.

A short explanation of the reasons for and nature of the various processes through which the metal passes, may render clearer a description of the plant.

The first step in the manufacture of steel from iron ore is to separate the iron from the various substances associated with it in that form. This is accomplished by smelting the ore in a blast furnace with fuel and flux, whereby much of the impurities is removed, and a cast iron, commonly known as pig iron, is obtained. The pig iron thus produced is still an impure grade of

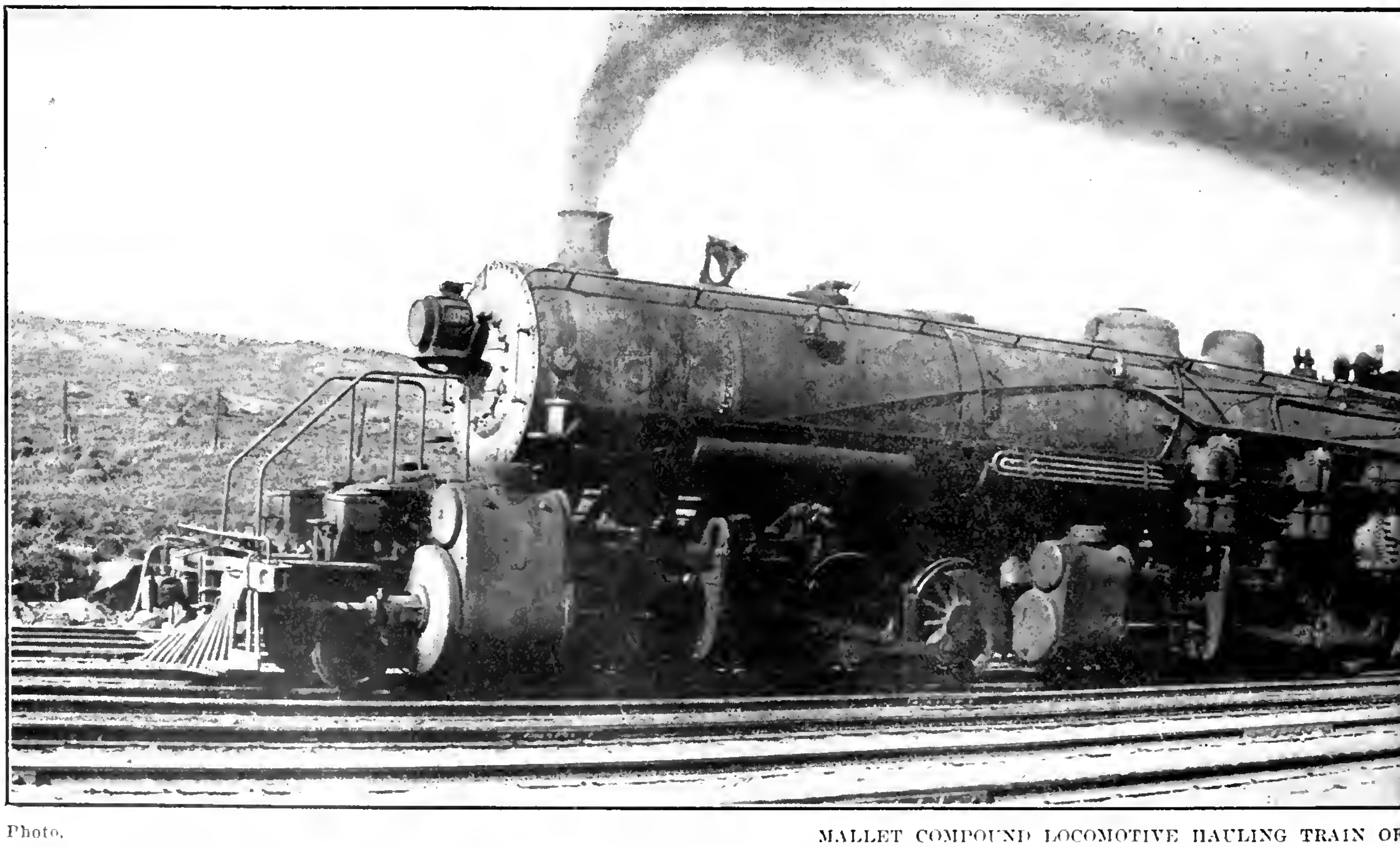


Photo. MALLET COMPOUND LOCOMOTIVE HAULING TRAIN OF

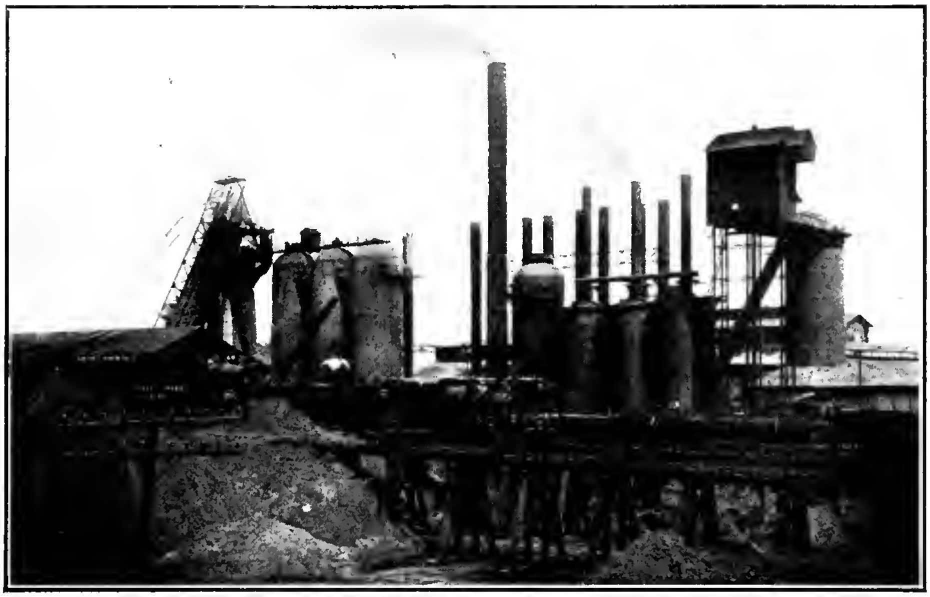
iron, containing roughly 1.00 per cent. silicon, 0.1 per cent. sulphur, 1.50 per cent. phosphorus, 1.50 per cent. manganese, 3.50 per cent. carbon. A steel suitable for projectile manufacture would have a composition approximately thus: .15 silicon, 0.03 per cent. sulphur, 0.05 per cent. phosphorus, 0.70 per cent. manganese, 0.50 per cent. carbon. In order to obtain metal of this composition it is necessary to remove nearly all of the various impurities from the pig iron, and then add the necessary proportions of such ingredients as are desired.

This constitutes steel-making proper, and may be accomplished by various processes, all of which are similar in general principles, though differing widely in certain features which have important bearing on the finished produce.

After the desired chemical composition has been obtained, the steel is subjected to various mechanical treatments terminating with its appearance in the shape of the now familiar shell forging.

The Blast Furnace

Returning now to the blast furnace—the iron ore arrives in hopper bottom cars, which are run out on elevated tracks and dumped in huge storage piles in close proximity to the blast furnace. Limestone and coke, which are necessary materials in steel-making, are similarly stored.



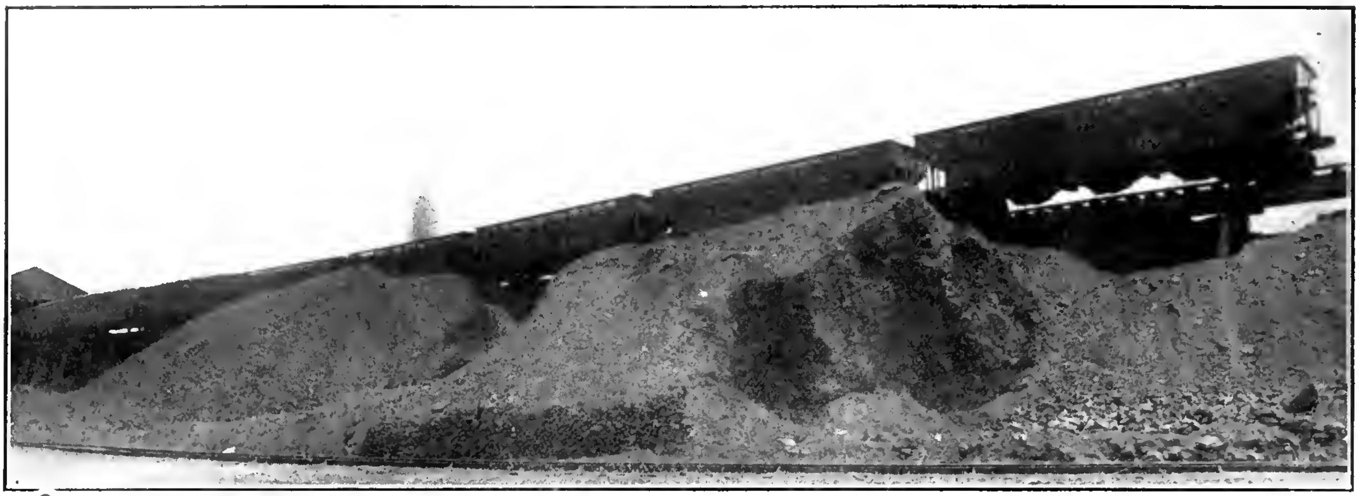
BLAST FURNACE PLANT OF THE STEEL COMPANY OF CANADA, LTD., HAMILTON, ONT.

A sectional view of the blast furnace with skip hoist and charging bins is shown on page 465.

The charging bins are situated well above ground level, the discharge spouts being so arranged that the necessary amounts of ore, coke and limestone may be fed into a travelling dump car provided with scales, and running on a track below the bins. The car empties its load of material into the skip, two of which are used, one descending to be filled when the other ascends with the charge for the furnace. When the loaded skip nears the top of the hoist tracks, projections on the ends of the rear axle engage with suitable curved guide rails, and tip the skip over so that its contents are discharged into the hopper on top of the furnace. This hopper is of double construction, being fitted with two bells or cones A and B. Bell B is held against the bottom of the upper hopper by a counterweight, and is opened by hydraulic gear, thus allowing the charge to fall into the main hopper I, which in turn is closed by bell A. When hopper I has been charged with the proper quantities of ore, limestone and coke, bell A is opened, while bell B is kept tightly

LOADED CARS FROM ORE MINES TO LAKE SUPERIOR — Gallagher, Duluth.

closed. The contents are now precipitated into the furnace, while the gas is prevented from escaping by bell B and going to waste as formerly, thus giving rise to the long flame which some years ago was such a prominent feature of blast furnace plants.



STORAGE PILES OF IRON ORE AWAITING TREATMENT IN BLAST FURNACE.

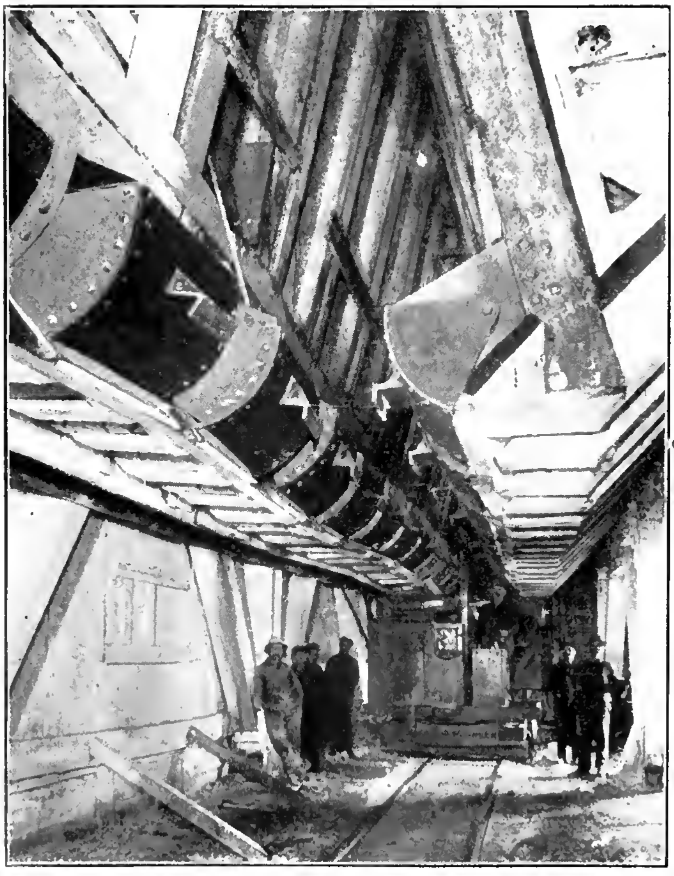
Design

As will be observed from the drawing, a blast furnace consists of a vertical brick-lined shaft, the internal shape being of a special outline, which has assumed its present form and proportions as the result of experience and scientific investigation. The lining of the furnace consists of acid (silicious) fire-brick, into the outer surface of which are built numerous water pipes for cooling purposes. These are easily seen in the photograph on page 466.

Encircling the lower part of the furnace is the blast pipe L, which supplies air to the furnace through the tuyeres N. The tuyeres, 12 in number, extend through the lining, the openings or "notches" as well as the tuyeres being cooled by water circulating through special pipes and hollow shields.

The hearth is the lower portion of the furnace, about 8 ft. in height, with vertical sides. Above that for a distance of 12 ft. is a portion of gradually increasing diameter, known as the bosh. From the top of the bosh, which is the largest diameter of the furnace, the walls close in gradually, forming the stack, which extends upwards to the throat where the charging hopper is located.

About three feet below the level of the tuyeres a hole is provided, known as the "cinder notch" or "monkey." This is protected by a water-cooled casting, and is closed by means of an iron plug. The purpose of this hole is to draw off the cinder and prevent it reaching the level of the tuyeres. On a level with the bottom of the crucible, on the front side of the furnace, is the iron tap-hole through which the liquid metal is drawn off from the furnace. This is simply a large hole in the brick work, which is stopped with clay balls. In tapping the furnace, these balls are broken up with a bar, and in order to stop the hole again a mud gun is employed, which shoots the balls of clay into the hole. This gun is seen lying at the base of the furnace in photograph on page 466.



ELECTRICALLY DRIVEN CHARGING CAR WHICH WEIGHS THE ORE, COKE, ETC., AS DELIVERED BY OVERHEAD CHUTES FROM CHARGING BINS.

Blowing Engines

The air which is necessary to operate the furnace is supplied at a pressure of from 15 to 30 lb. per sq. in., according to furnace conditions. The blowing engines for supplying this air are of a type which is more or less peculiar to blast furnace plants, and one of these is shown in a photograph on page 465. They are what are known as disconnected compound, long cross-head blowing engines. The steam cylinders are 44 in. and 84 in. diameter by 60 in. stroke, and are placed above the blowing cylinders, which are located between the flywheels.

Before entering the furnaces the air is heated to a temperature of 900 to 1,250 deg. Fahr. by passing through the hot blast stoves. These stoves, of which there are three, are distinctive features in the appearance of blast furnace plants. They are upwards of 100 ft. high and 20 ft. in diameter.

The hot gas from the top of the blast furnace is conveyed through large pipes to the base of the stoves, where it is mixed with air and burned. The products of combustion pass upwards through the central passage and then downward through the surrounding space, which is constructed of suitably arranged fire-brick chambers, after which the gases escape through the chimney. After running for a certain period, the stove has absorbed a maximum amount of heat from the gases, and the process is then reversed. The air from the blowing engines is now re-

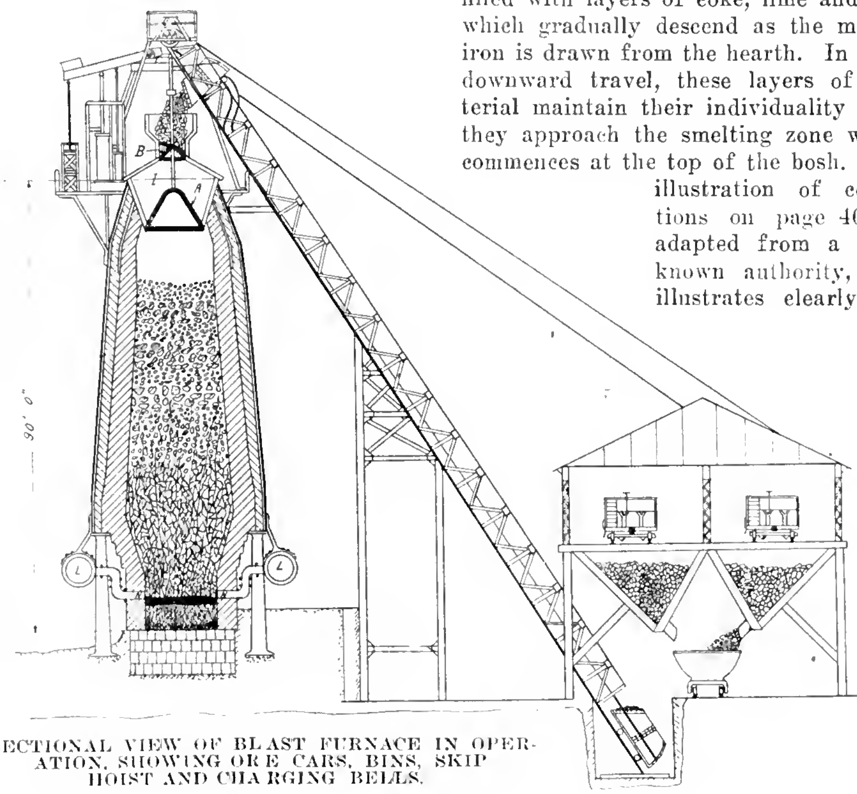
ceived through a valve at the base of the chimney, and, passing upwards through the hot fire-brick, is raised to a high temperature before passing out at the bottom of the central passage and thence to the tuyeres. When this reversal takes place, the hot gases from the furnace are switched into that stove, which was previously heating the air. While one stove is heating the air, the remaining stoves are being warmed up by the hot gases. In order to maintain a fairly regular temperature in the blast furnace, the stoves are changed over about once an hour.

Utilizing the Waste Gases

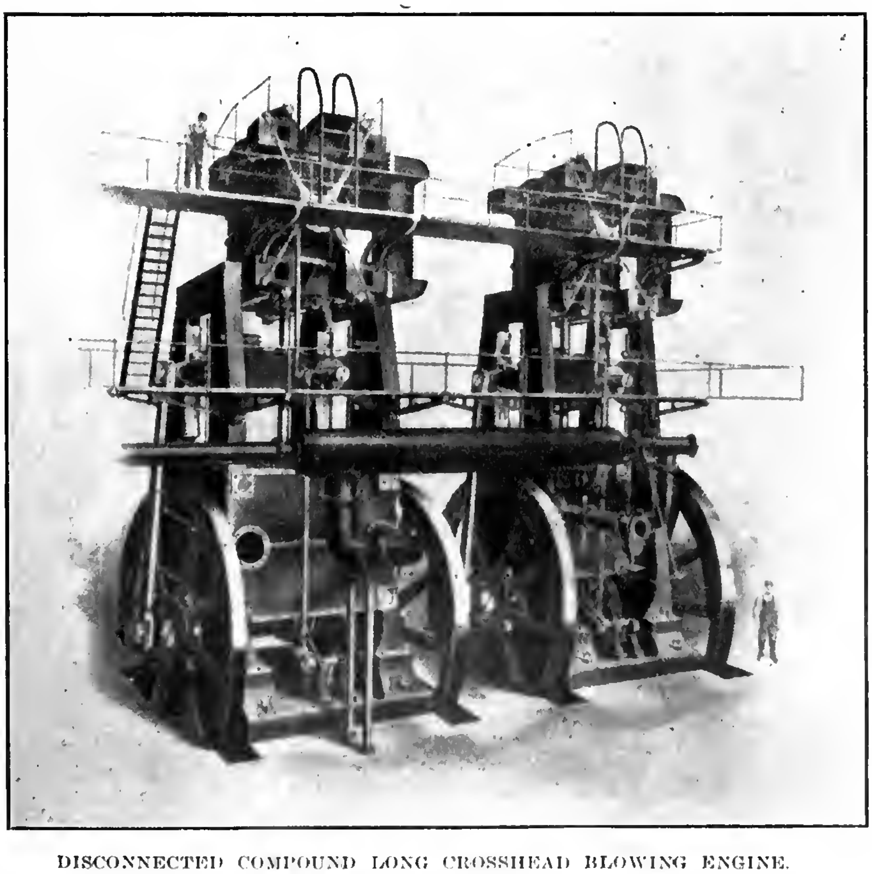
Only one-third of the waste gases from the blast furnace is necessary to keep the stoves hot, and the remaining two-thirds are available for use in various ways. In the case of this plant, the gas is burned under a battery of boilers, producing the steam required to operate the blowing engines and refrigerating plant which is required for drying the air before entering the stoves.

Undried air, if blown directly into the furnace, would carry with it water vapor equivalent to from 1 1/3 to 8 gallons per minute, according to the humidity of the air, materially cooling the smelting zone of the furnace. The process of drying the air by refrigeration was originated by James Gayley, a prominent American steel maker, and the saving in fuel and increased regularity of working due to the absence of moisture have resulted in its adoption by the leading plants in various countries.

The air-drying plant consists of three 150-ton compound steam-driven ammonia compressors, which supply the necessary refrigeration for cooling the brine which is circulated by three steam-driven flywheel type brine pumps.



SECTIONAL VIEW OF BLAST FURNACE IN OPERATION, SHOWING ORE CARS, BINS, SKIP HOIST AND CHARGING BELLS.



DISCONNECTED COMPOUND LONG CROSSHEAD BLOWING ENGINE.

Operation of the Blast Furnace

When in operation, the furnace is filled with layers of coke, lime and ore, which gradually descend as the molten iron is drawn from the hearth. In their downward travel, these layers of material maintain their individuality until they approach the smelting zone which commences at the top of the bosh. The illustration of conditions on page 466 is adapted from a well-known authority, and illustrates clearly the action of the various materials. The exact location of the smelting zone is dependent upon the volume and pressure of blast, size of furnace, character of slag made, etc., but will extend from the level of the tuyeres to a few feet above them, or about to the top of the bosh. It will require perhaps fifteen hours for the material to descend from the top of the furnace to the smelting zone. During this descent, it is upheld partly by the resistance of the uprushing column of hot gases, partly by its friction on the walls of the furnace, and partly by the loose column of coke which extends through the smelting zone and to the bottom of the furnace, and which alone resists melting in the intense heat of this zone. The oxygen of the air blast attacks all the coke in the smelting zone and as much of it below the level of the tuyeres as is not covered by accumulations of iron and slag in the hearth, producing a large volume of carbon monoxide gas (CO), and a temperature which may exceed 3,000 deg. Fahr. This CO along with the nitrogen of the blast passes up between the particles of solid material, which takes up the greater part of their heat. The CO also performs certain chemical reactions, and thus in both ways the rising column of gases prepares the charge for its final reduction in the smelting zone.

Smelting the Iron

When the charge has travelled about half-way down the furnace, the in-

creased temperature breaks up the limestone, and from this point down to the smelting zone the ore is gradually re-

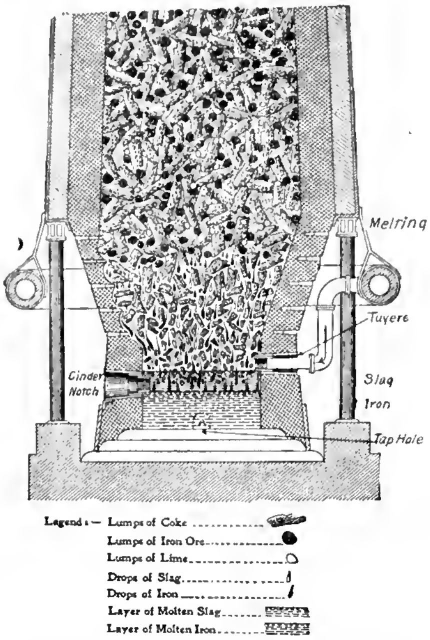


DIAGRAM SHOWING VARIOUS STAGES IN PROCESS OF SMELTING IRON ORE.
From Howe, "Iron, Steel and other Alloys."

duced to metallic iron. This spongy iron is impregnated with deposited carbon, which is absorbed in a similar manner to the process known as carbonizing. This reduces the melting point of the iron, and causes it to become liquid at a higher point above the tuyeres than it otherwise would.

On reaching the smelting zone, the iron melts and trickles quickly down over the columns of coke, from which it completes its saturation with carbon. At a corresponding point the lime unites with the coke ash and impurities in the iron ore, forming a fusible slag, which also trickles down and collects on the hearth. It is during this transit that the different impurities are reduced by the carbon, and the extent of this reduction determines the characteristics of the pig iron, for in this operation as in all smelting, reduced elements are dissolved by the metal, while those in the oxidized form are dissolved by the slag.

The slag is drawn off through the cinder notch four or five times, between each tapping of the furnace, which takes place about every six hours. This is run through channels in the sand floor to ladle cars at the side of the cast house, whence it is taken to the water front and dumped into the bay, making an ideal foundation for the reclaimed land which is being gradually brought into existence on the company's lake front.

Tapping the Furnace

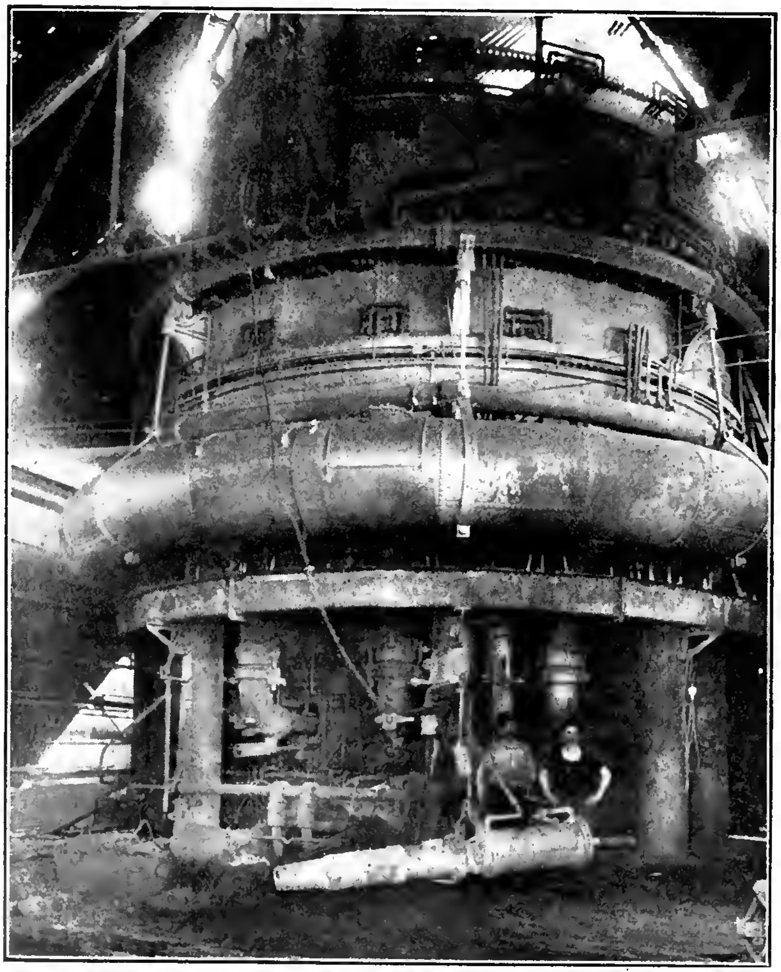
The scene in the cast house when the furnace is tapped is one which impresses even the most passive observers. The tap hole is opened by breaking up the clay balls which were forced into it, forming a solid plug. The molten iron flows underneath a skimmer, which deflects the floating slag into its own runner, while the iron flows into brick-lined ladles at the end of the cast house, which are immediately transferred to the open-hearth department and deposited in a large cylindrical vessel known as the mixer, where it is kept hot until it is time to charge it into the open-hearth furnace, where further changes in its composition are affected, which finally transform it into that indispensable metal—steel.

Manufacture of Steel

The physical properties possessed by iron as produced in the blast furnace are such as to render it unsuited for shells. The large proportion of carbon and other impurities present impart a brittleness and absence of ductility which are entirely absent when these substances are wholly or partially eliminated. This elimination or purification is performed by various processes, but the chemical action of oxidation is common to all.

The particular process of purification adopted by the Steel Company of Canada is that known as the basic open-hearth process, and differs sufficiently from other processes to demand a brief description. In all cases of purification, i.e., steel-making, the impurities are removed from the pig iron by means of oxidation—that is to say, the molten metal is subjected to the action of oxygen either in the form of air or iron oxide or both. The name of Bessemer naturally occurs to many people in connection with steel-making, and in the pro-

EXTERIOR VIEW OF BLAST FURNACE. SHOWING PIPES FOR CONVEYING WASTE GASES TO STOVES. DUST SEPARATOR IN FOREGROUND.

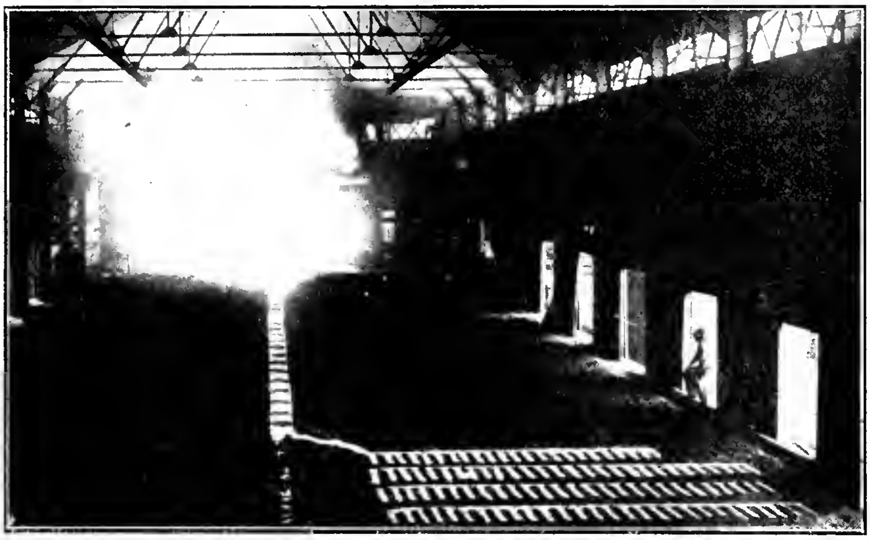


BASE OF STACK SHOWING LARGE BLAST PIPE SUPPLYING AIR TO THE TUYERES. STEAM OPERATED MUD GUN IN FOREGROUND USED FOR PLUGGING TAP HOLE BEHIND THE MUZZLE.

cess invented by the late Sir Henry Bessemer, air alone is used to remove the impurities from the molten iron.

Bessemer Process

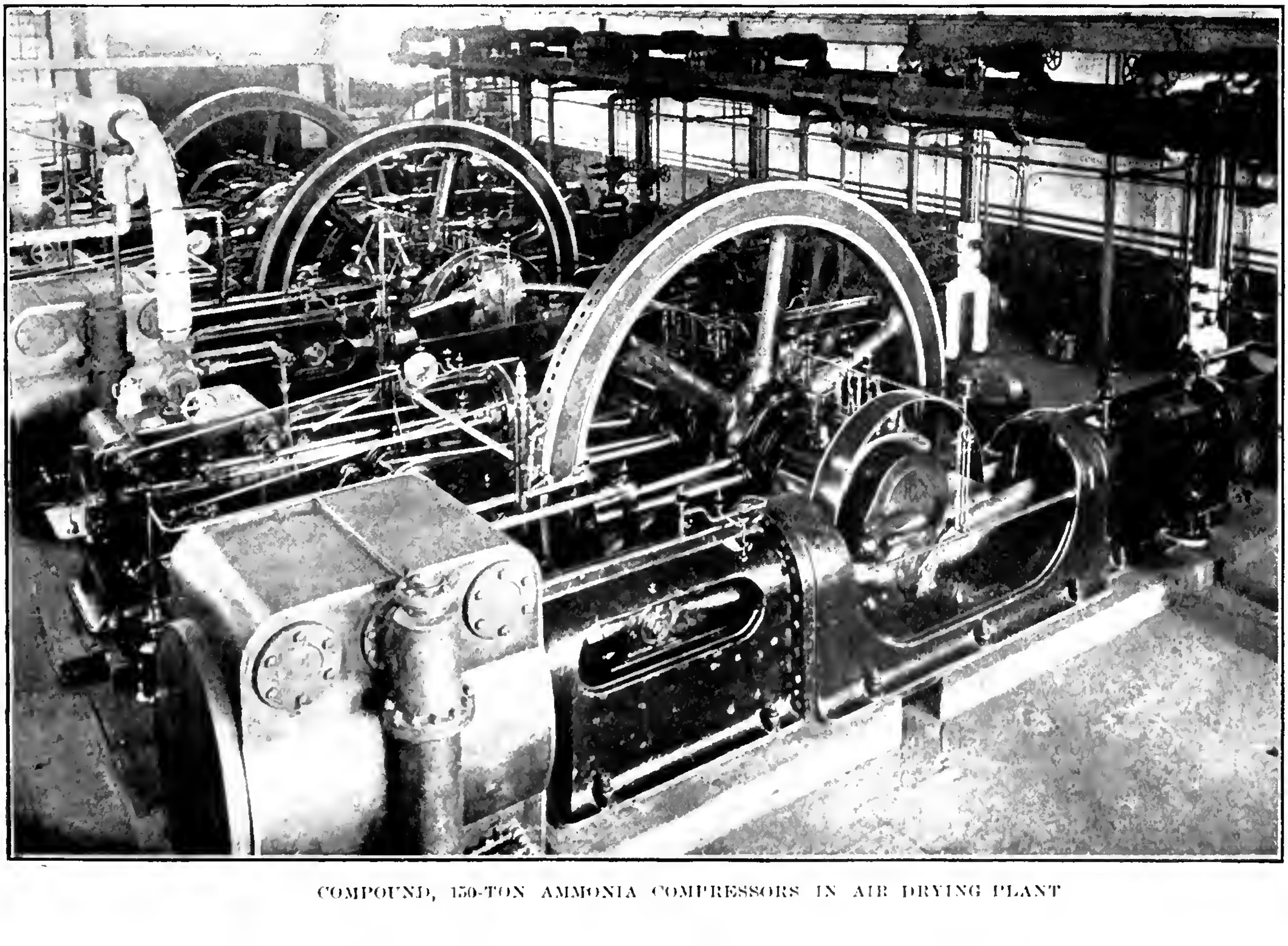
A large pear-shaped vessel known as a converter is lined with suitable protective material and provided with means whereby air can be forced upwards from the bottom with sufficient force to bubble through the molten metal. A converter, as the receptacle is termed, with a capacity of 15 tons, would require 30,000 cu. ft. of cold air per minute. The effect of such treatment on the iron impresses the lay mind chiefly by reason of its peculiar physical aspect, but no matter how wonderful its behaviour and appearance during this treatment, the resulting changes in the physical properties of the metal are little short of marvellous. A concise description of a "blow" or "heat" is given by Bradley Stoughton. "In about four minutes the silicon and manganese are all oxidized by the oxygen of the air and have formed a slag. The carbon then begins to oxidize to carbon monoxide, CO, and this boils up through the metal and pours out of the mouth of the vessel in a long brilliant flame. After another six minutes the flame shortens or 'drops' the operator knows that the carbon has been eliminated to the lowest practicable limit (say 0.04 per cent.), and the operation is stopped. So great has been the heat evolved by the oxidation of the impurities that the temperature is now higher than it was at the start, and we have a white-hot liquid mass of relatively pure metal. To this is added a carefully calculated amount of carbon to produce the desired degree of strength or hardness, or both; also about 1.0 per cent. of manganese and 0.15 per cent. of silicon. The manganese is added to remove from the bath the oxygen with which it has become charged during the operation, and which would render the steel unfit for use. The silicon is added to get rid of the gases which are contained in the bath. After adding these materials, or 'recarburing' as it is called, the metal is poured into ingots, which are allowed to solidify, and are then rolled, while hot, into the desired size and form."



CAST HOUSE, SHOWING THE MOLTEN IRON BEING RUN INTO MOULDS OR PIGS.

Basic Open-Hearth Process

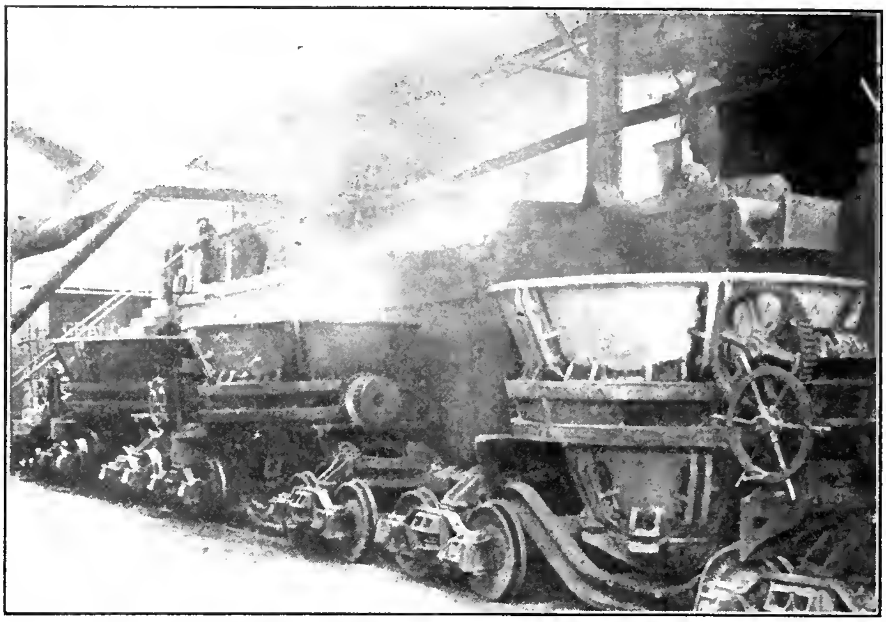
The open-hearth process in operation at this plant differs considerably from



COMPOUND, 150-TON AMMONIA COMPRESSORS IN AIR DRYING PLANT

the Bessemer process, and its use in preference to the other is due to a complexity of circumstances, such as nature of ores available, quality of product desired, demands of customers, etc. The basic open-hearth differs from the acid open-hearth in the nature of the lining and the composition of the slag produced, the effect of which is to aid greatly in the removal of phosphorus and sulphur, thus permitting the use of high phosphorus ores as distinguished from low phosphorus ores, which are necessary for both Bessemer and acid open-hearth practice.

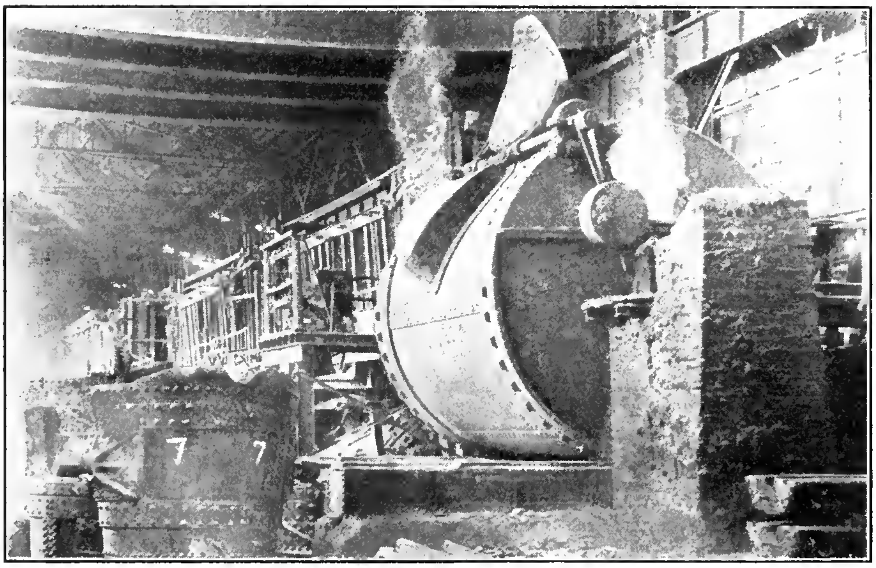
A sectional view of the furnace plant is given on page 469, while the accompanying views of the melting platform, charging machine, casting pit and ingot teeming give a good idea of the actual conditions under which the work of steel making is carried on.



RUNNING SLAG FROM THE BLAST FURNACE INTO LADLE-CARS.

Furnace Arrangement

The furnaces, which are in continuous operation, are of the stationary type, in which the metal is drawn off through a tap hole in the sides (see photo of casting pit). The melting platform or charging floor is on the other side of the furnaces and on the same level as the hearth. Two charging machines travel along this floor on rails, while directly in front of the furnaces is a standard gauge track on which trucks convey the scrap metal and limestone which are deposited in the furnaces through the various doors shown. Spanning the casting pit, which is situated on actual ground level, are two traveling cranes for handling the ladles in charging, teeming, etc. The mixer, which is at one end of the casting pit, is also served by these cranes.



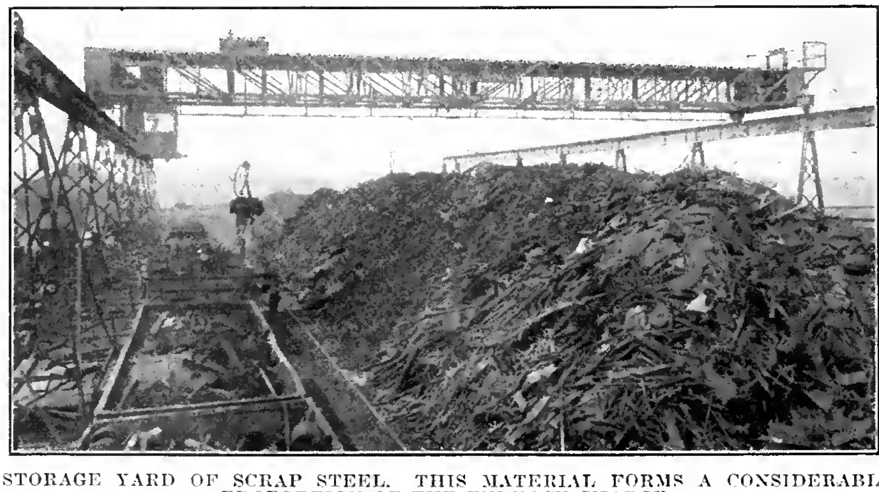
THE MIXER WHICH RECEIVES THE MOLTEN IRON TO PREPARE IT FOR TREATMENT IN OPEN-HEARTH FURNACE.

Situated on the opposite side of the charging floor and at a lower level are the gas producers, which supply the necessary fuel for the furnaces. Regenerators or preheating chambers are built beneath the charging floor, and perform a similar function to that of the hot blast stoves in connection with the blast furnace.

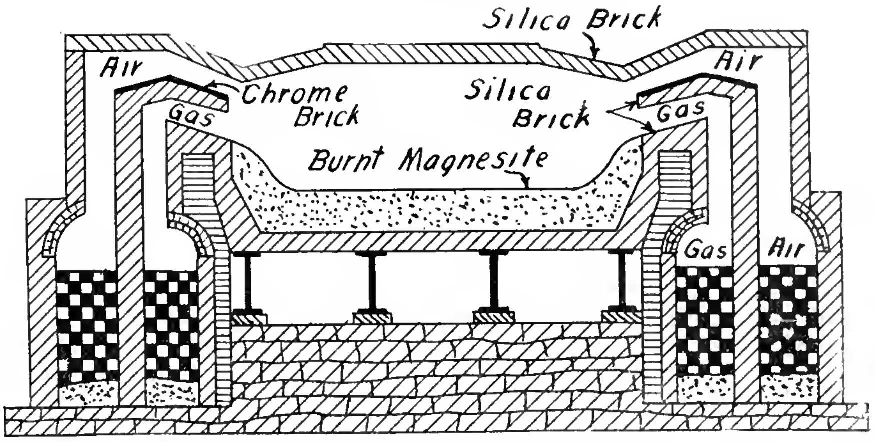
Construction of Furnaces

A longitudinal section of one of the furnaces is given on page 469, from which the principle of construction can be understood. The hearth in which the metal lies is formed of a shallow dish-like depression, which in the case of a 50-ton furnace is about 24 inches deep. The bottom is composed of a magnesite brick shell on which is built up a special lining of calcined magnesite with a small proportion of anhydrous tar, which acts as a binder. This magnesite and tar is deposited on the surface, where the tar is immediately incinerated, forming a strong frame work, which holds the magnesite securely in place. By means of successive layers this protective coating is built up to a thickness of 18 inches.

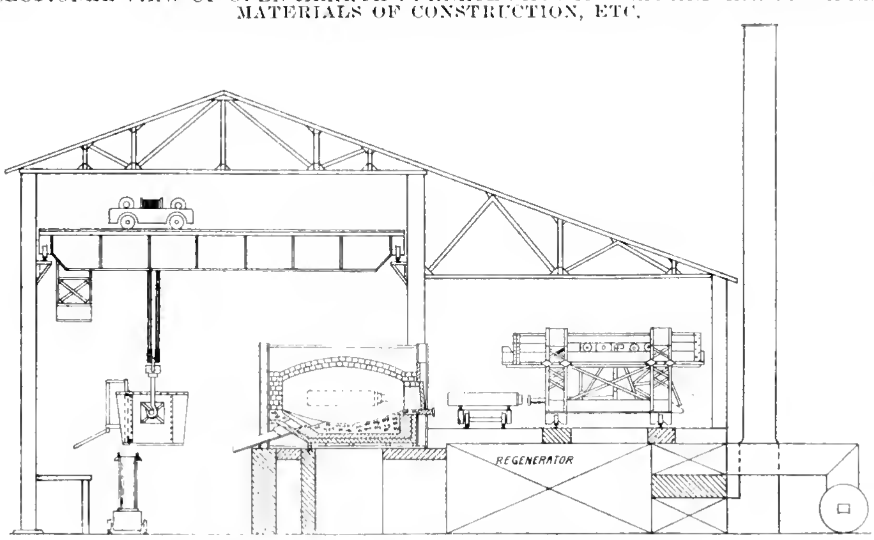
The fuel and air enter the furnace through separate ports at the same end of the furnace. Ports are provided at



STORAGE YARD OF SCRAP STEEL. THIS MATERIAL FORMS A CONSIDERABLE PROPORTION OF THE FURNACE CHARGE.



SECTIONAL VIEW OF OPEN-HEARTH FURNACE SHOWING GAS AND AIR PASSAGES, MATERIALS OF CONSTRUCTION, ETC.



SECTION OF OPEN-HEARTH FURNACE BUILDING.

both ends, however, so that each pair of ports alternately acts as exit for the products of combination, which are conveyed through the regenerators to the chimney flue. After a suitable lapse of time the ports are reversed, so that the incoming gas and air is heated by the regenerators which were previously being heated by the waste gases, the ports which formerly supplied the fuel and air now acting as exits and allowing the regenerators in their flues to be heated again.

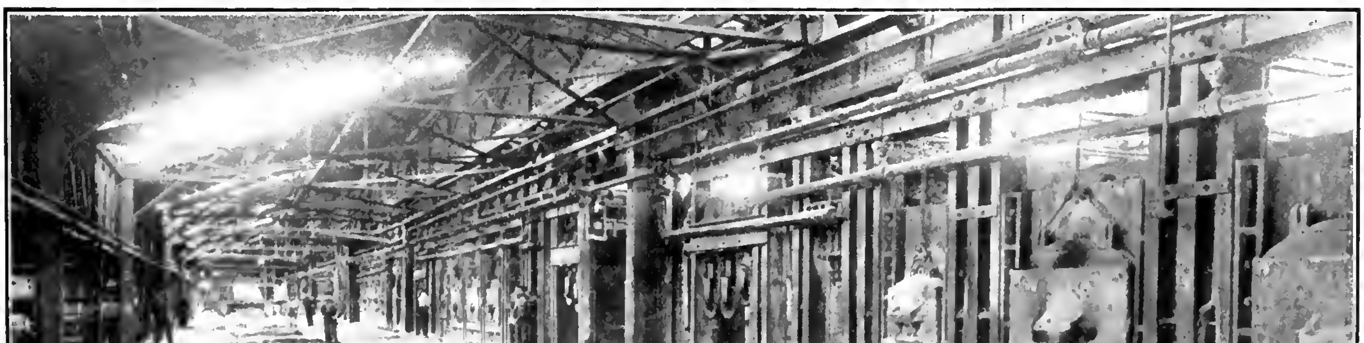
Charging the Furnace

In charging the furnace, the charging machine is placed opposite the furnace door. Between the machine and the door is a truck with a number of long buckets containing limestone. One end of each bucket is specially formed so that the arm of the machine is able to pick it up and carry it forward into the furnace and then revolve it, so that the contents are distributed equally over the bottom. Steel scrap and other cold metal is then added, and lastly, the molten iron from the blast furnace, which has been held over in the mixer till the furnace is ready to receive it. This molten iron is charged through a special door on the casting pit side of the furnace. The object in charging this last is to avoid damage to the furnace lining, which would result from dropping solid lumps of stone and metal into the liquid iron.

The charge melts down in about five hours or so. When this is complete, the melter takes a sample and continues to do so at stated intervals, until the laboratory tests show the desired composition. The charge is now run off through the tap hole, which was securely closed by forcing material into it from the inside of the furnace. As will be observed in the illustration of the casting pit, a gallery extends round the furnace close to the tap hole, and the hole is pierced by a man from this position. The metal pours out in a state of great fluidity, its appearance being like white hot water. After 35 or 40 tons are in the huge ladle, the surface ripples and waves, due to the pouring, continue to travel back and forth across the surface, and indicate in a most impressive manner the wonderful nature of the operations incidental to the production of steel.

The results of the various reactions which take place in the open-hearth furnace are these.

The molten lime absorbs the silicon, manganese and phosphorus with a proportion of sulphur, after which it floats on the surface of the metal and protects it from being oxidized by the furnace gases. The carbon content is brought down by introducing iron ore at a suitable time, the

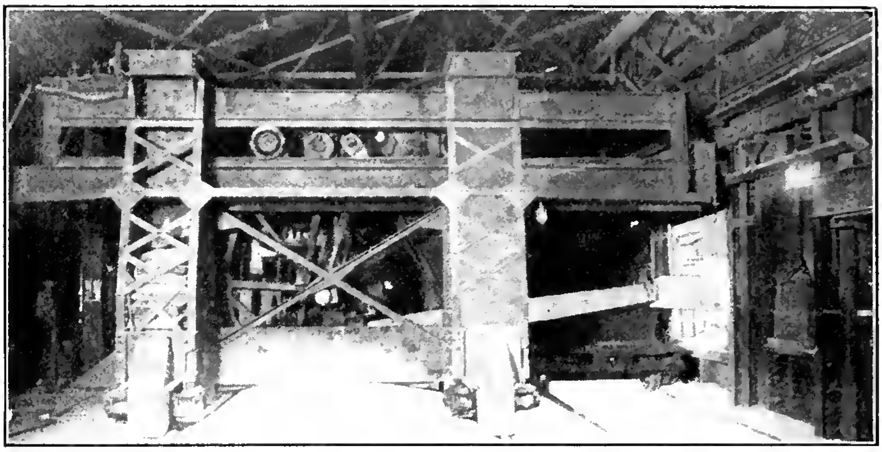


CHARGING FLOOR IN OPEN-HEARTH BUILDING. FURNACES ON RIGHT.

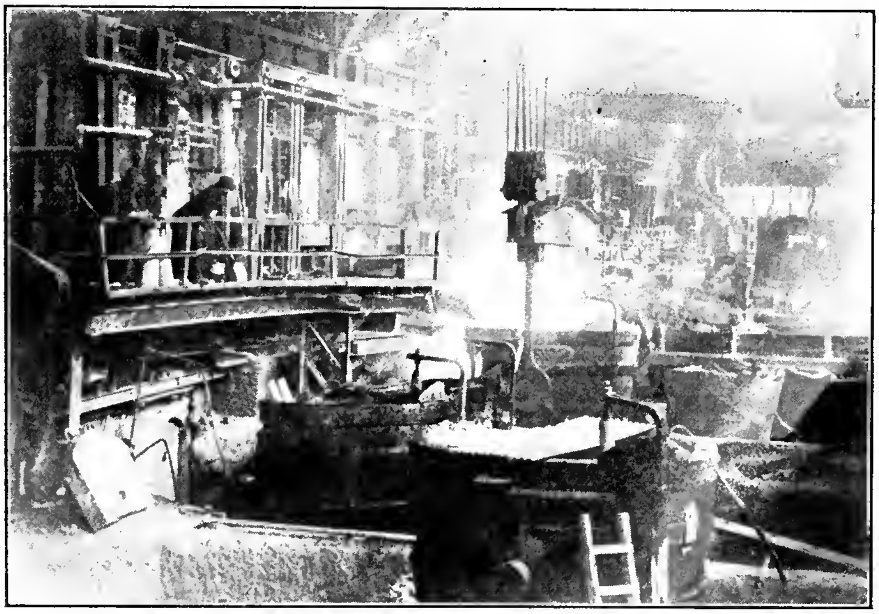
oxygen of which combines with the carbon, boiling off and escaping as gas.

While the metal is running off into the teeming ladle it is recarburized by adding to it the necessary quantity of ferro-manganese and charcoal or coke. These materials are prepared in suitable size, and at a given time during the filling of the ladle, two large paper bags containing the mixture are thrown in from the gallery. About half of the carbon content of the materials is absorbed by the steel, and if all calculations and operations have been correctly made and carried out, the steel has now a composition roughly as follows: Silicon, 0.15 per cent.; sulphur, 0.03 per cent.; phosphorus, 0.05 per cent.; manganese, 0.70 per cent.; carbon, 0.50 per cent.

deposits it in a section of the soaking pit, where it is maintained in an upright position at a steady temperature for about one hour. This treatment is necessary to allow the ingot to attain an even temperature throughout, and also to confine the pipe or segregation core to the centre.



CHARGING MACHINE DEPOSITING MATERIAL IN FURNACE.

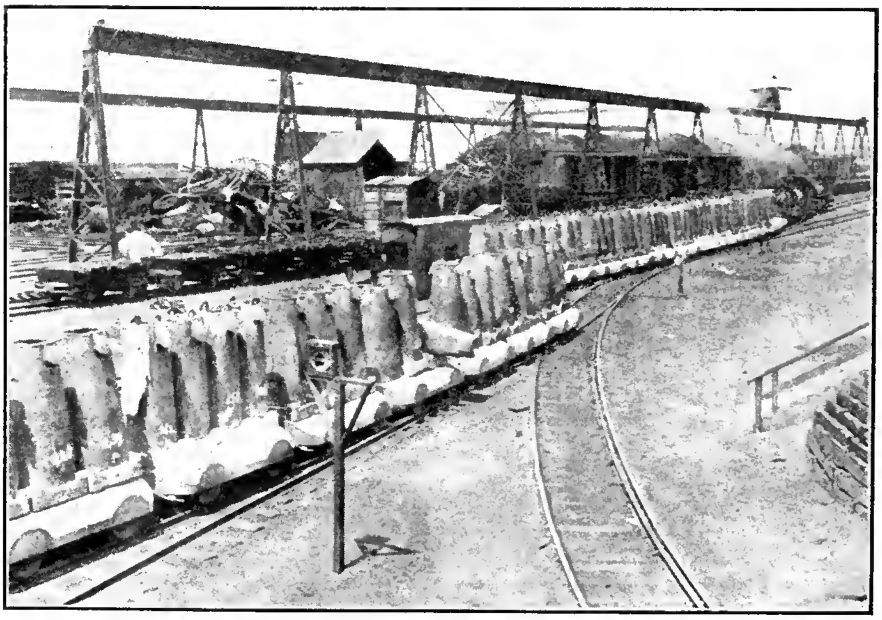


CASTING PIT. RUNNING CHARGE FROM FURNACE INTO TEEMING LADLE

Each soaking pit furnace supplies heat to four holes, 5 ft. x 8 ft. 6 in., capable of holding eight ingots each, and served by a 10-ton soaking pit crane installed by the Morgan Engineering Co. These furnaces are fired by producer gas generated by four Morgan gas producers. They are provided with regenerating chambers similar to the open-hearth furnaces, suitable chambers and passages being provided for reversing the flow of the gases in order to utilize all of the heat. A photograph on page 471 gives a view of the top, showing the hydraulic cylinders which operate the doors. These doors are made of fire-brick tiles, supported in a suitable frame and run on wheels giving easy access to the various pits. The actual manufacture of the steel is now completed, as all subsequent operations are of a more

Teeming

The pouring of the molten steel into moulds is known as teeming. The teeming ladle is made of heavy sheet steel lined with fire-brick and provided with a stopper or plug which fits into a hole in the bottom. The stopper is controlled by a handle which allows the operator to control the flow of metal into the ingot moulds, the ladle being moved over each mould by the overhead crane from which it is suspended. These moulds are of very massive cast iron construction and rest on stools carried by the cars. After the ingot moulds are filled, the train of cars is taken to the rolling mill, by which time the metal is sufficiently solidified to allow the mould to be drawn off or stripped, as shown in photograph. This is done by a 75-ton Alliance crane, which has a pair of links which grip the mould under the lugs and pull it up clear of the ingot. Another crane immediately grips the ingot and

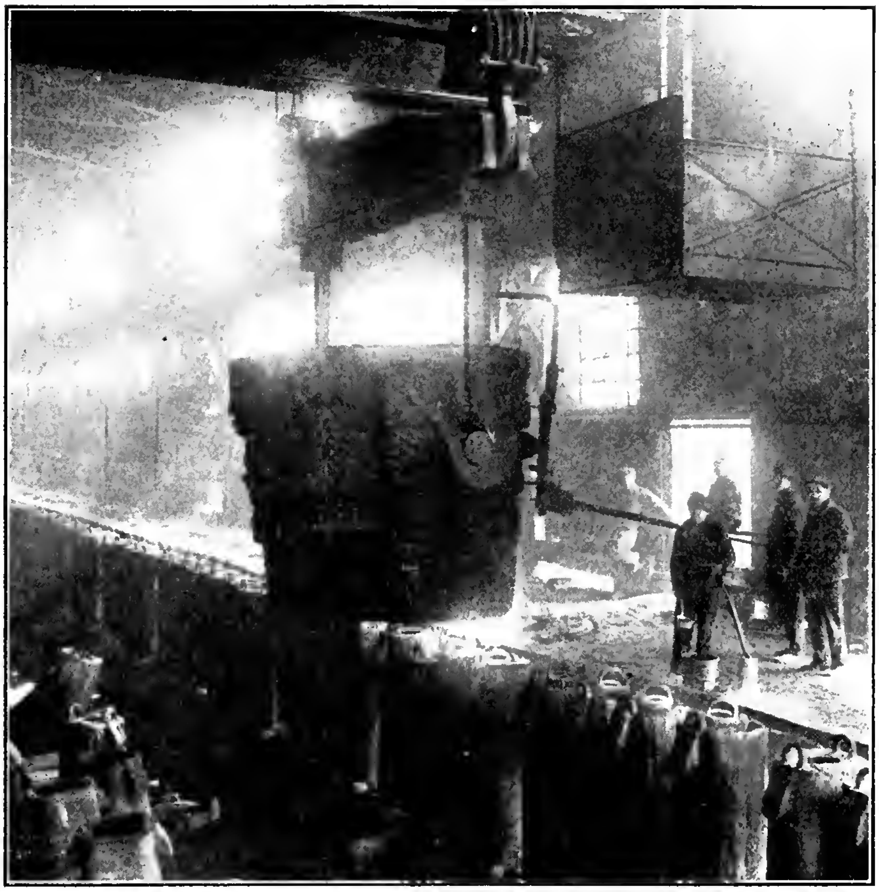


TRAIN OF INGOT MOULDS EN ROUTE TO ROLLING MILL.

or less mechanical nature, and exercise no decisive influence on the chemical composition or quality of the steel.

The Mechanical Treatment of Steel

Steel which is cast, i.e., poured into moulds after being drawn from the furnace, is subject to certain defects, the prevention and removal of which can be accomplished by suitable means. Ingotism, piping and segregation are three of the defects liable to occur in steel. The former consists of the formation of excessively large crystals which form when molten steel is cooled too slowly, and also when it is not poured at the correct temperature. This crystalline structure when allowed to take place may persist throughout the entire ingot, whereas piping and segregation are more of a localized nature.



"TEEMING" THE MOLTEN STEEL INTO INGOT MOULDS.

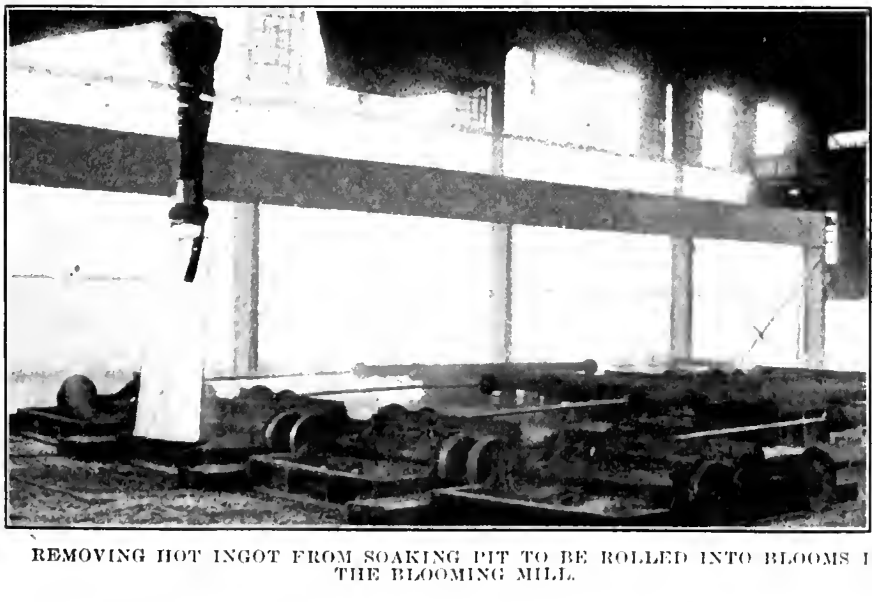
Piping, the term applied to the central porous core at the upper end of the ingot, is due to the shrinkage of the outer layers which induces an outward flow of the still liquid metal in the centre. This reduction in internal pressure also facilitates the evolution of contained gases which fill up the spaces left by the solidifying metal, resulting finally in the peculiar structure known as a "pipe."

Segregation is a partial separation of the various ingredients from the iron during solidification, due to the difference in fusibility of the various impurities and the iron itself. As the presence of some of the impurities lowers the melting point of the iron without increasing their own solubility, the result is that when the lower layers of steel solidify, a small portion of the impurities is rejected and passes upward into the still molten metal. This action proceeds upward through the ingot until when the topmost metal reaches the point of solidification, the percentage of impurities present is considerably greater than in the bulk of the ingot.

Segregation and piping cannot be entirely eliminated, but by suitable treatment and the use of deoxidizers, such as aluminum, etc., the trouble can be not only greatly reduced, but localized, so that the cropping of a comparatively small portion of the upper end of the ingot removes completely all possibility of harm from these causes. The progress made in this direction will be realized from the fact that although specifications for shell steel called for the discard of 40 per cent. of the ingot when operations were commenced, the thoroughness of manufacture and the resulting high quality of material have enabled this loss to be reduced below 15 per cent. with a large margin of safety.

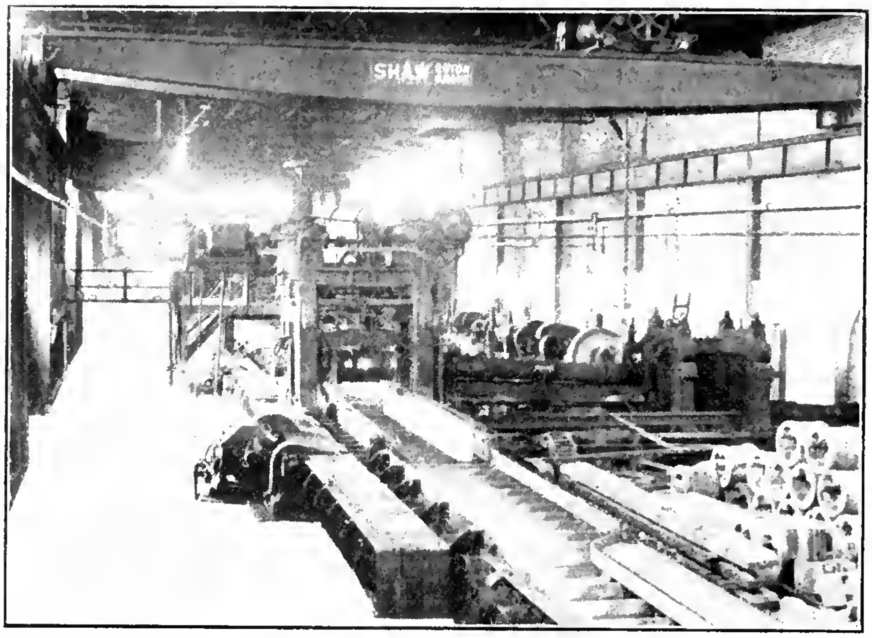
Rolling the Steel

Having now been in the soaking pit



REMOVING HOT INGOT FROM SOAKING PIT TO BE ROLLED INTO BLOOMS IN THE BLOOMING MILL.

STRIPPING THE MOULD FROM THE HOT INGOT.



ELECTRICALLY-DRIVEN REVERSING BLOOMING MILL.

long enough to attain the necessary condition as regards solidification and temperature, the ingot is withdrawn from the pit by the crane and deposited on the approach table of the blooming mill. The ingot, which is 15 in. x 17 in. x 7 ft. long, is passed back and forth between massive steel rollers, which while reducing its cross-sectional area, increases its length until, when reduced to about 6 inches square, the bloom, as it is now termed, is 50 ft. in length.

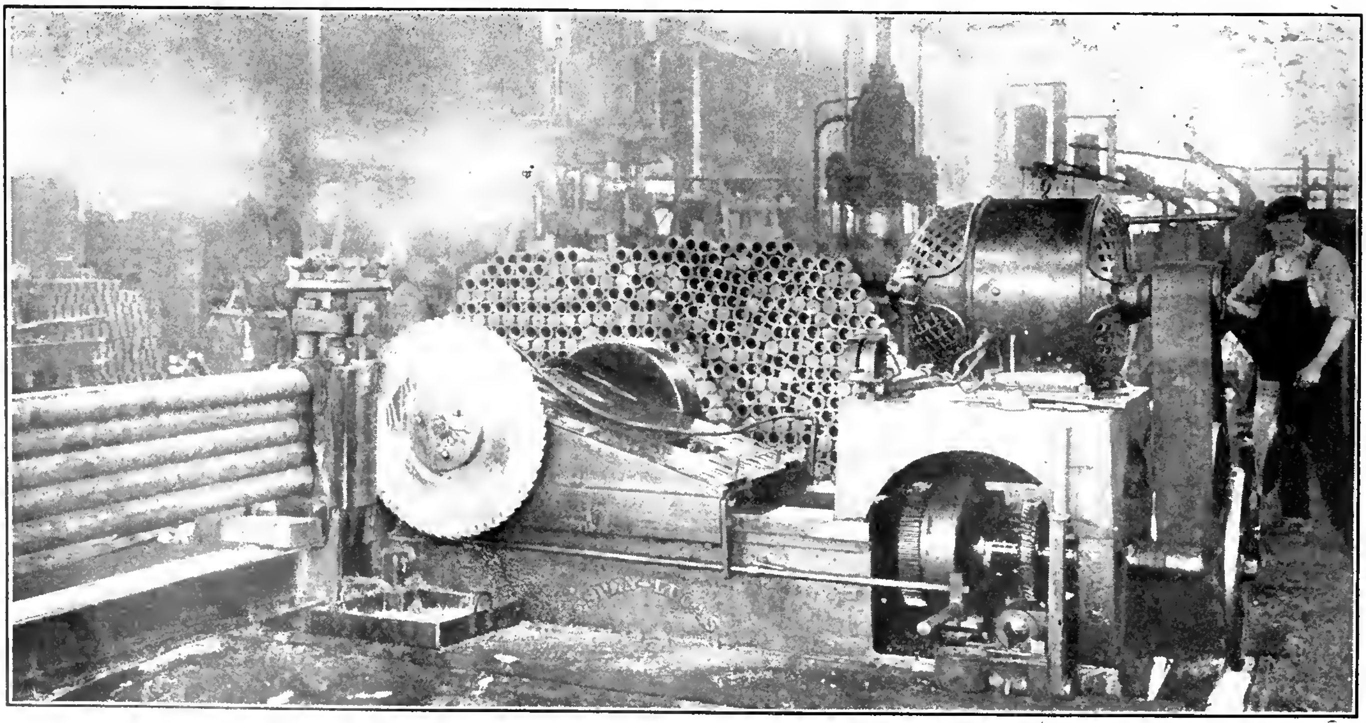
A photograph on this page shows a semi-finished bloom entering between the rollers of this mill, which is very complete in design and construction and along with its power plant is one of the best examples of modern steel working machinery on this continent.

The installation consists of a two-high 34-inch reversing motor-driven blooming mill designed by the Morgan Construction Company and built at the Lloyd-Booth plant of the United Engineering and Foundry Co., Pittsburgh, and is served by a Shaw 20-ton crane. The approach table in the immediate foreground is operated by a 30 horse-power direct-current motor, while the tables on either side of the mill are driven by 100-horse-power motors. The side guards for handling the bloom from one part of the rolls to another, are operated by hydraulic gear to the right of the tables. Here are also located the pinion housings. The lower pinion is directly coupled to the motor shaft, which passes through the wall into the power house; the other end of the pinion shaft is coupled to the lower roll of the mill.

The spindle or shaft which connects the upper pinion with the upper roll is provided at either end with a flexible coupling or wobbler, so that the spindle may assume an inclined position as the upper roller is raised or lowered to suit the thickness of metal passing between the rolls. The traveling crane is provided with special tackle to facilitate changing rolls and replacing pinions, etc., in case of accident. The entire operation of the mill is controlled from a platform or pulpit located above the table, affording a clear view of the rolls and the work.

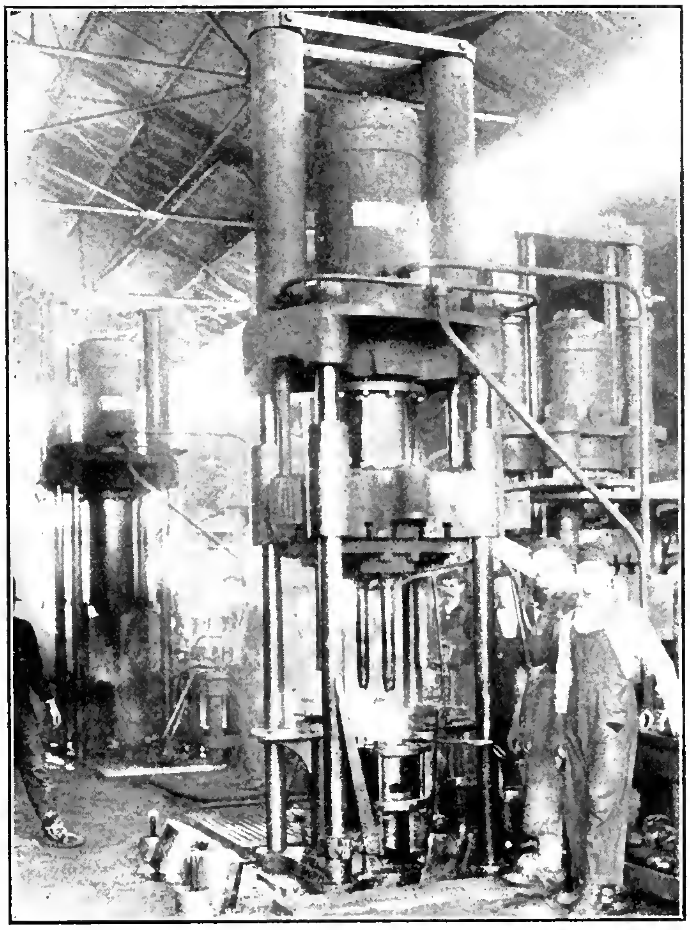
After being reduced to the desired size, which is accomplished in 15 to 18 passes, the bloom is cut to suitable lengths in a 10 x 10-inch vertical bloom shear, which then go to the finishing mill, which reduces them still further to a round section of suitable diameter according to the size of shell to be made.

The blooming mill is driven by a 3,000 horse-power normal rating twin armature reversing motor, constructed by the Canadian Westinghouse Co., Hamilton, Ont., operated by electric power purchased from the Dominion Power & Transmission Co., which operates a 42,000 h.p. hydro-electric plant near St. Catharines, Ont., about 40 miles distant. The current, which is received at 44,000 volts, 66 2/3 cycles, is stepped down to 2,200 volts three-phase for the large motors and to 220 volts, two-phase, for several smaller motors and for lighting


ELECTRICALLY-DRIVEN SAW CUTTING FIVE BARS OF SHELL STEEL AT ONCE.

and all other purposes throughout the plant.

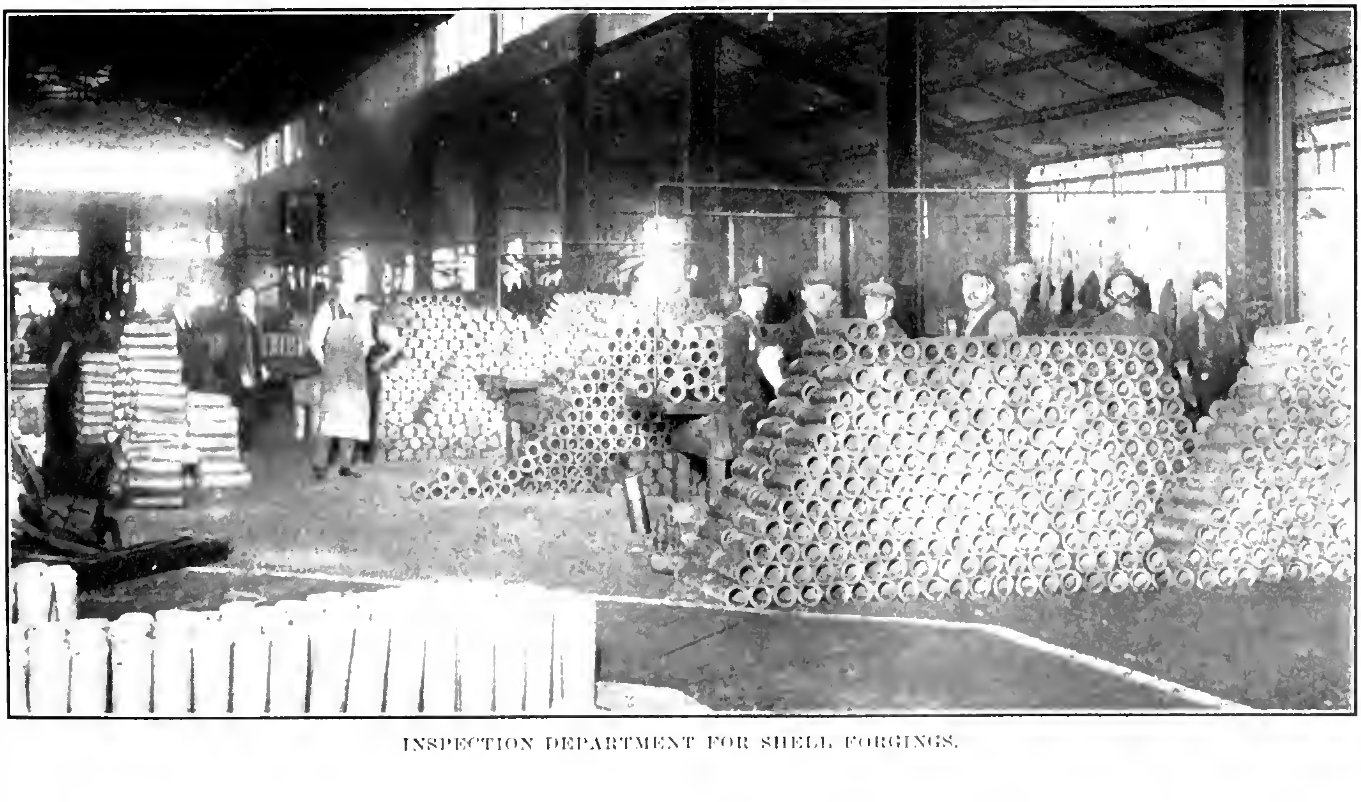
When breaking down ingots into blooms for the billet mill, the steel is given 18 passes through the rolls, but when breaking down for 6 x 6-inch blooms, the number of passes is reduced to 15. It is apparent, therefore, that the loads on the motor-generator set which supplies power to the reversing motor will vary rapidly over a wide range, the rate of change at times aggregating 4,000 to 5,000 horsepower per second during acceleration and approximately the same when braking. A load of this kind from the standpoint of power supply would be exceedingly undesirable and the cost of the current necessarily would be excessive. The twin armature reversing motor, while rated at 3,000 horse-power is, therefore, designed to carry a momentary peak load of 8,000 horse-power, receiving the necessary electrical energy through the medium of a motor-generator flywheel set consisting of one 1,800 horsepower alternating current, 2,200-volt, three-phase motor mounted on a common shaft with a 50-ton flywheel and two 1,200 kilowatt generators. This set is located in a power house on the other side of the wall from the blooming mill. Under light loads the fly-wheel has a speed of 500 r.p.m., while under the heaviest loads its speed does not fall below 400 revolutions per minute. The flywheel stores up energy during the period of light load and attains its maximum speed. When the heavy momentary loads comes on, the speed of the flywheel is allowed to drop, thus enabling it to deliver some of its stored-up energy in order to help the generators supply sufficient power to the reversing motor without making excessive demands on the external supply of electrical power.



VIEW OF SHRAPNEL FORGING PRESS SHOWING PUNCHES FOR PIERCING THE SHELL BLANKS.

To enable the flywheel to assist the 1,800 horse-power motor to drive the two 1,200 kilowatt generators, during maximum demand periods, an automatic slip regulator has been installed, which introduces resistance in the rotor circuit as the output to the set increases, the speed thereby being reduced and a portion of the flywheel energy utilized for driving the two generators. Reducing the load on the generators automatically cuts out the resistance, and as the speed increases, energy is again stored in the flywheel.

The speed and direction of the rotation of the 3,000 horsepower motor are controlled by changing the polarity of the generators and varying their field strength, thereby varying the voltage applied to the armatures of the mill motor. This eliminates rheostatic losses except in the field circuit and permits any desired speed to be obtained independent of the load. As a result of this arrangement, no peak loads are taken off the line and the current input to the motor-generator set is maintained practically constant. The blooming



INSPECTION DEPARTMENT FOR SHELL FORGINGS.

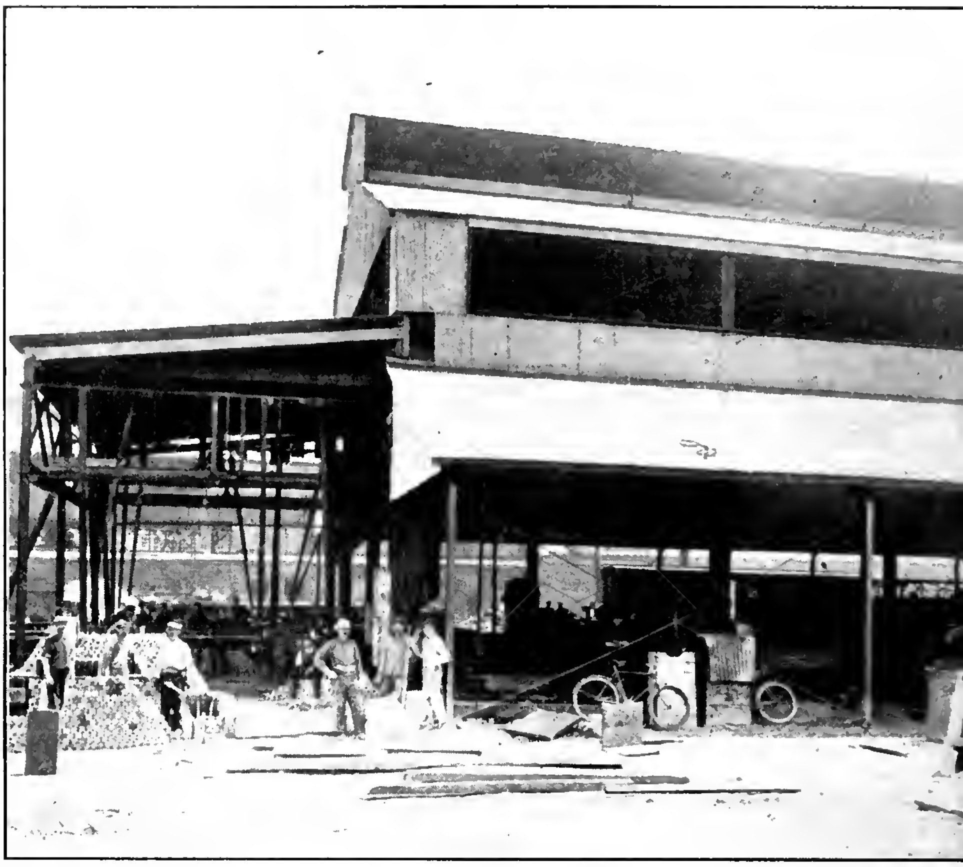
mill motor complete weighs 429,000 pounds, and the rotating part, which operates at a maximum speed of 100 revolutions per minute, weighs 164,000 pounds. This motor is provided with a thrust bearing on its shaft and a braking coupling is installed between the bearing and the pinion housing. The flywheel set weighs 367,130 pounds, and the rotating part weighs 240,000 pounds.

Ventilation is provided by a Sirocco fan installed by the American Blower Co., Detroit, which has a capacity of 24,000 cubic feet of free air per minute.

Forging the Shell

The round bars, from which the shell forgings are made, are of considerable length and must be cut to an exact size so that excess material or waste is reduced to a minimum. The bars or "rounds" as they are termed by the trade are cut off by electrically driven cold saws as illustrated on page 472. This photograph shows one of several machines which are engaged continuously on this work. The long bars are clamped in a frame or rest which holds them in a curved position corresponding to the curve of the circular saw so that all five bars are cut through simultaneously, and no time is lost waiting for the last bar to be finished by itself as happens in some cases.

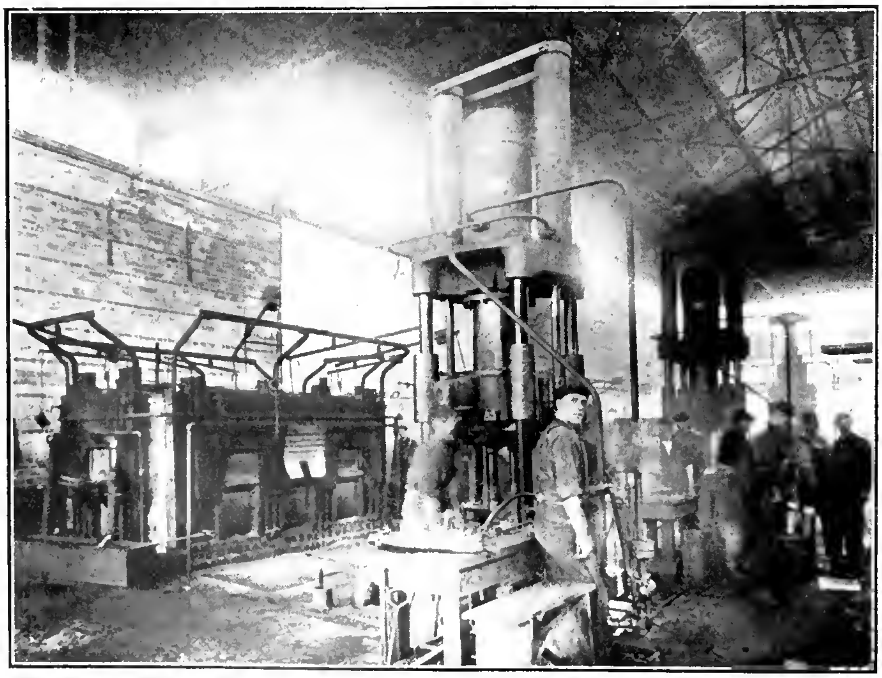
All forgings for shrapnel and 4.5-inch shells are produced by hydraulic presses, the two-operation method being adopted as the most satisfactory. In order to handle the immense volume of work involved, an entirely new forging shop with complete equipment was installed and has already produced innumerable forgings for both shrapnel and 4.5-inch high explosive shells.



FORGING SHOP ERECTED FOR PRO

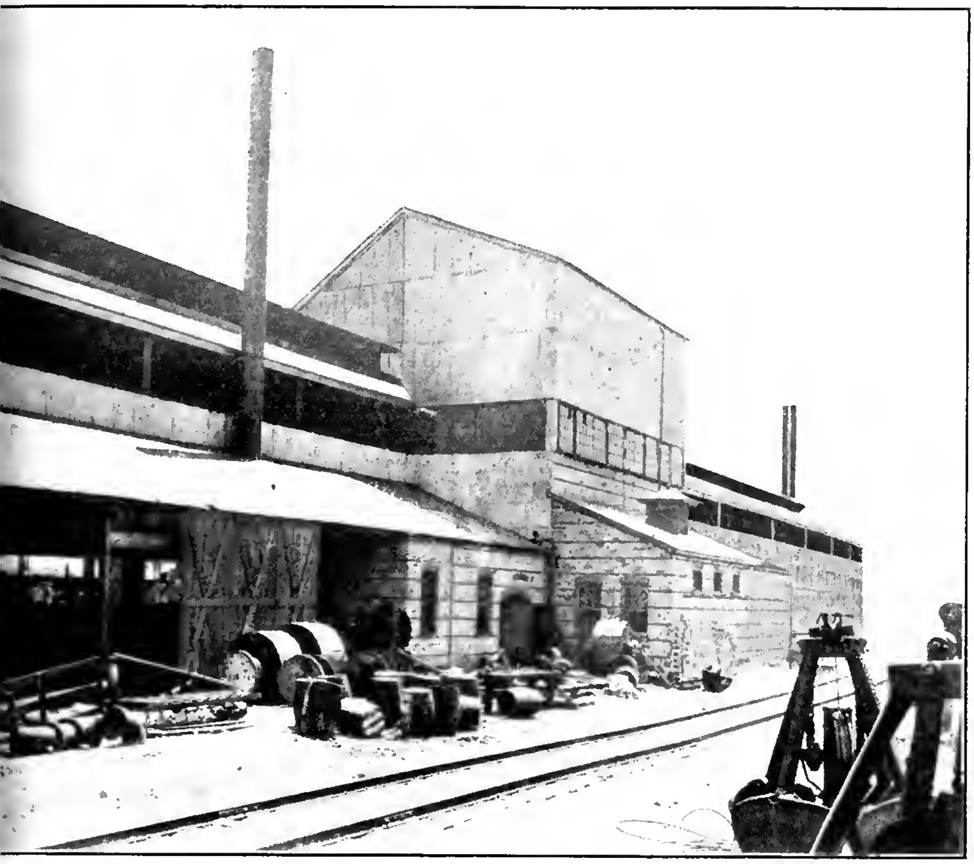
From the cold-sawing machines, the billets, as the pieces are called, now proceed to the heating furnaces where they are carefully brought up to the necessary temperature. The shrapnel billet is $6\frac{1}{2}$ inches in length by 3 5/16 inches diameter and is forged at a temperature between 1,900 to 2,100 degs. F.

The process of forging as performed here consists of two operations, viz., piercing the solid billet, and then drawing the pierced billet out to length, this second operation including cupping or forming the pocket for powder cup. The north portion of the building is devoted to shrapnel forgings exclusively while the south end houses the 4.5 department. Each installation is complete with numerous hydraulic presses, heating furnaces, etc., the hydraulic power being supplied from a central station on one side of the building at the centre. Views of these departments are shown on this page, also the stock of finished forgings undergoing inspection by government officials. When piercing, the hot billet is placed in a cup-shaped die, and a round nose punch is forced into it causing it to fill out and extrude upwards around the punch. Suitable stripping gear removes the pierced billet from the die, and it is immediately transferred to an adjoining press for cupping and drawing.



VIEW IN SHRAPNEL FORGING DEPARTMENT.

In order to form the interior to the desired shape, the point of the drawing punch is made to the proper outline and the press is moved downward forcing the punch into the bottom of the billet which rests in a cupping die placed in position temporarily. Solid stops are arranged to arrest the travel of the punch at the required point after which the punch with the forging on it is raised slightly to allow the cupping die



NGS FOR 3.3 IN. AND 4.5 IN. SHELLS.

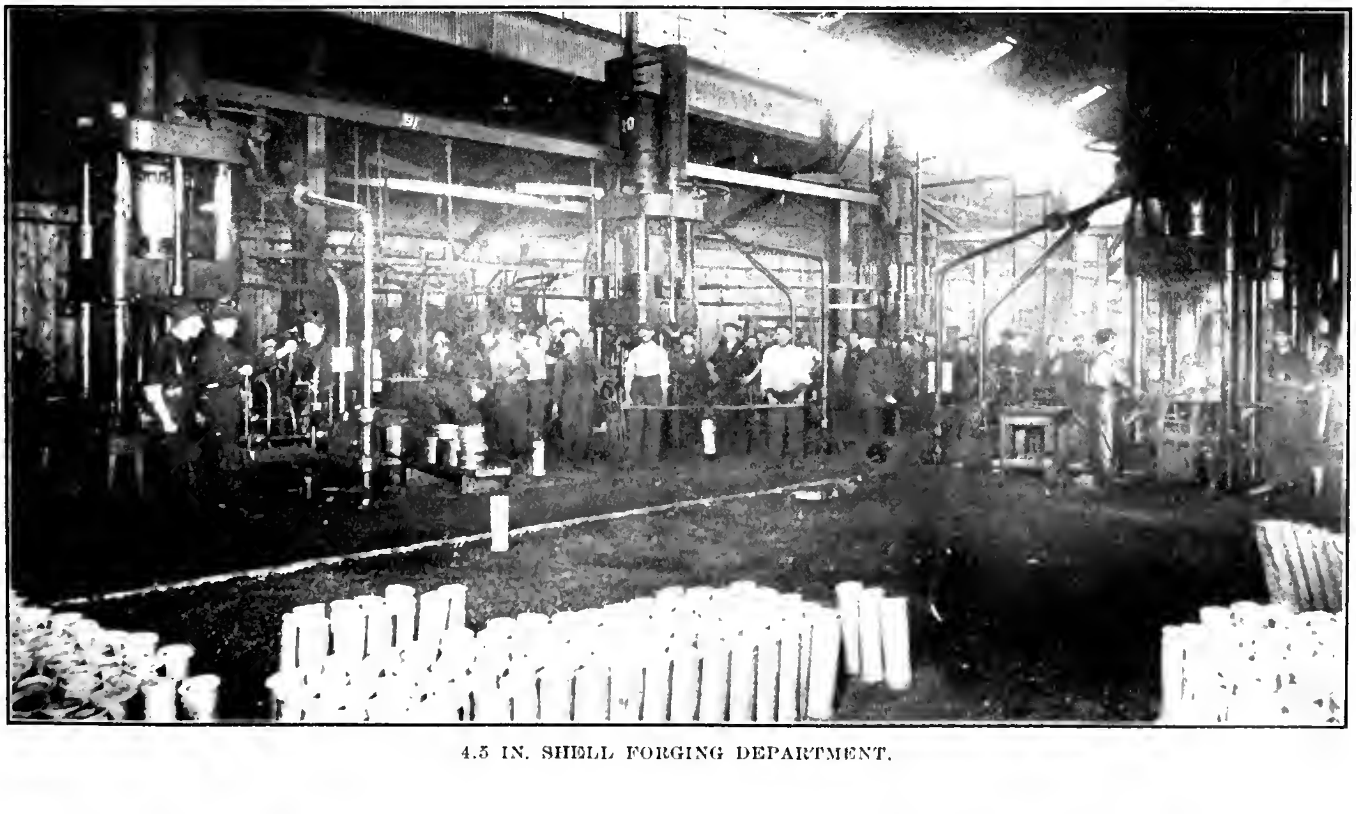
to be removed. The punch is now forced down through the drawing dies which draw the hot metal up around the punch giving the proper outside diameter to the forging which now has the form of a tube with one end closed.

The finished forgings are now deposited on end in large groups on a cinder floor which retards the cooling sufficiently to avoid any trouble due to air hardening, etc. As each forging leaves the drawing press, it is stamped with a number indicating the heat or melt of metal from which it is made, and is gauged for depth of bore and thickness of wall. After cooling it is finally inspected and marked after which it is transferred to the machine shop for completion, or forms one of the great number of forgings supplied by the company to numerous machine shops throughout the Dominion, engaged in machining and assembling shells and components.

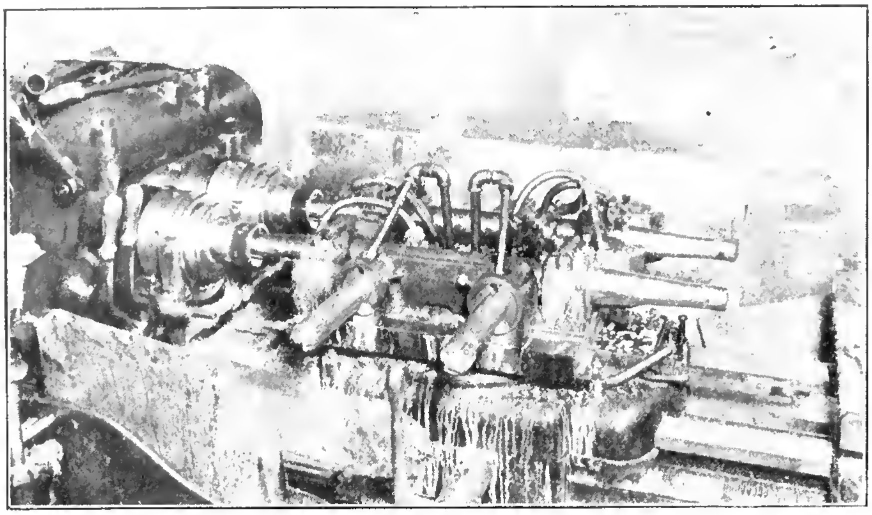
Finishing and Loading the Shell

The machining of the shell forging is done in fully-equipped machine shops, where the various operations, with which so many of our workers are familiar, are performed with all possible haste. Cutting off the rough forging to length, turning, boring, waving form the preparatory work followed by heat treating and nosing, after which threading, fitting base plugs, finishing to exact shapes and weights are all necessary before the shell is delivered from the machine to the assembly bench. Here may be seen the bullets being packed and the resin poured in to form a solid mass, which will behave in the desired manner while traveling through air from the muzzle of the gun. Varnishing the interior of high explosive shells is an operation that has to be thoroughly carried out in view of the deleterious action of the explosive on bare metal.

The assembling of the copper bands by hydraulic presses is one of the most interesting of the many operations which conclude with the painting and boxing of the projectiles, which then await shipment to the fixing plant to receive the charge of propellant contained in the brass cases which ultimately strew



4.5 IN. SHELL FORGING DEPARTMENT.



BORING EQUIPMENT ON DOUBLE SPINDLE J. AND L. FLAT TURRET LATHE.

pany's sentiments received concrete expression in the form of an athletic field, which is the home ground of a ball club of no small ability. Situated in front of the main offices, club room and library buildings, this expanse of green contrasts pleasantly with, and forms a welcome oasis in the midst of furnaces, mills, forges, machine shops, and railroad tracks.

The creature needs and comforts of all members of the staff are most carefully attended to in the staff building. A club restaurant, library, rest room, accident ward and hospital for sick and injured, are a few of many evidences of the reciprocal spirit of the plant, and in maintaining the surroundings in a high state of artistic excellence—well-kept grounds, vine-clad buildings, expert landscape gardening, etc.—the company betrays that attention and consideration for every detail, which has been an all-important factor in placing it in the enviable position which it now occupies as one of Canada's leading industrial establishments.

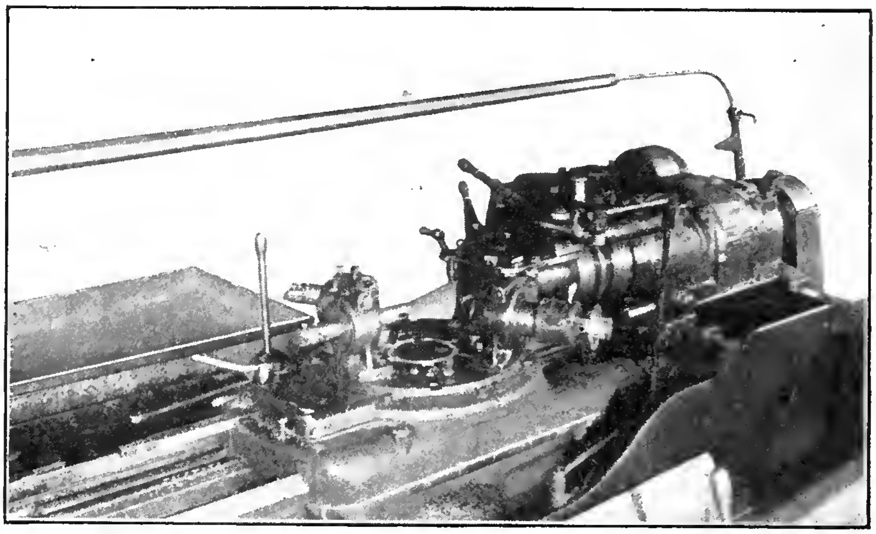
the battlefield in the region of artillery engagements.

The Spirit of the Plant

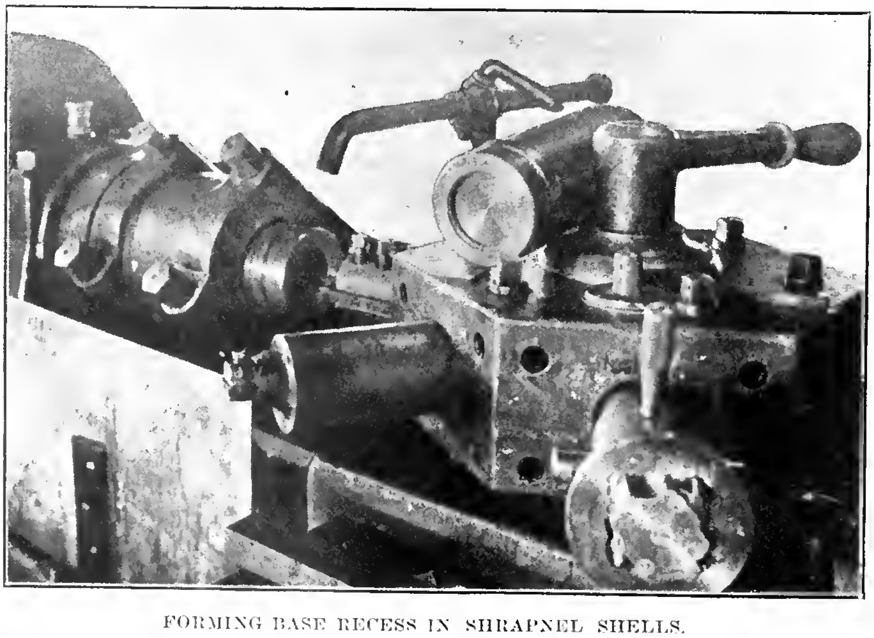
The vagaries of fate are well illustrated by the fact that while "doing their bit" in producing the much-needed material required by the Empire, the company, adhering to the most modern business policy, is an admirable exponent of the humane principles of "safety first." The mutual consideration for each other's interests which exists between the company and its army of employees is well evidenced by the environment of harmony which permeates the atmosphere of the entire organization.

In the midst of industry and activity, heat, smoke, grime, and other inseparable features of steel manufacture, the company has not failed to realize its moral duty to those whose toil and effort, both of brain and muscle, have helped to establish and maintain the position of the company in the foremost ranks of Canadian industry.

Firm believers in that old adage, "a sound mind in a sound body," the com-



MACHINING AND THREADING NOSE OF 18-PDR. SHRAPNEL SHELL.



FORMING BASE RECESS IN SHRAPNEL SHELLS.

SPECIAL WELDING METAL FOR IRON AND MILD STEELS

THE necessity for using welding metals specially made for the oxy-acetylene welding process should be recognized by all users of the process, says the Acetylene and Welding Journal.

Until recently no special welding metal for work on iron and mild steels existed, and it is well known that until the advent of such a metal, wires or rods of Swedish iron should be used in preference to all other welding metals. The French Welding Union have been carrying out a series of experiments with the object of obtaining a welding metal for iron and steel which would deoxidize the welds, increase their strength and more important still, increase their ductility.

Such an investigation is naturally a slow process because each rod made to a new or corrected formula must be followed by a series of practical and mechanical tests. These important researches were nearing completion and were to have been published in due course when the war intervened and the labors of the Union were turned in other directions.

It is well to emphasize that, apart from the welding rod, there are other conditions which must be rigidly followed if good welds on iron and steels are desired. It is safe to say that in the majority of workshops using the process these conditions are unfulfilled and advice on, say, the preparation of the edges, the power of the blowpipe and its position, the regulation of the flame and the execution of the weld itself could be given. Thus defective welds would, in many cases, be obtained with a perfect welding metal.

The use of ordinary iron or mild steel wire or rods is not to be recommended where sound strong welds are required. The use of Swedish iron gives a distinct improvement, but the welds obtained are still imperfect. The presence of impurities in these metals exerts a bad influence on the welds. The chief impurities being sulphur and phosphorus. A special welding metal for the welding of iron and mild steels has recently been placed on the British market under the name of Ferrox, and this product is manufactured entirely in England by a British firm's patented process. The metal is obtained by subjecting ordinary iron. steel, or cast iron to a process whereby the metal becomes impregnated with extremely finely divided nickel. and also holds in a state of occlusion or chemical combination a considerable quantity of hydrogen gas. It is claimed, after considerable research, that the welding rods obtained by this process effectively eliminate and counteract the disadvantages of the welding process. An example of the method of carrying out the invention is as follows:—

Hydrogen gas is passed over powdered nickel, or nickel oxide so that nickel chemically combines with the gas. The gas, thus charged with nickel is passed into a closed vessel in which the material to be treated is contained. The temperature and time of treatment play an important part. The gas is continuously passed over the metal or rods under a pressure slightly above atmospheric pressure. The time of treatment and the temperature employed will necessarily vary with the degree of impregnation required, with the thickness of the iron treated and its quality. When the treatment has been effected the product is cooled down in an atmosphere of hydrogen, or other inert gas.

Among the principal results obtained by applying this patented process are:—

(a)—The elimination of all oxides from the original material from which the welding wire is manufactured.

(b)—The expulsion from the original material of occluded gases.

The increased cost of this scientifically manufactured product over ordinary welding wire is small, and it is claimed that in spite of its increased cost, its use is attended with real economy. Apart from the relative merits it is cheaper than Swedish iron. In fact, the welding rod forms a very small percentage of the total cost of a weld.

EXPANDING MANDREL

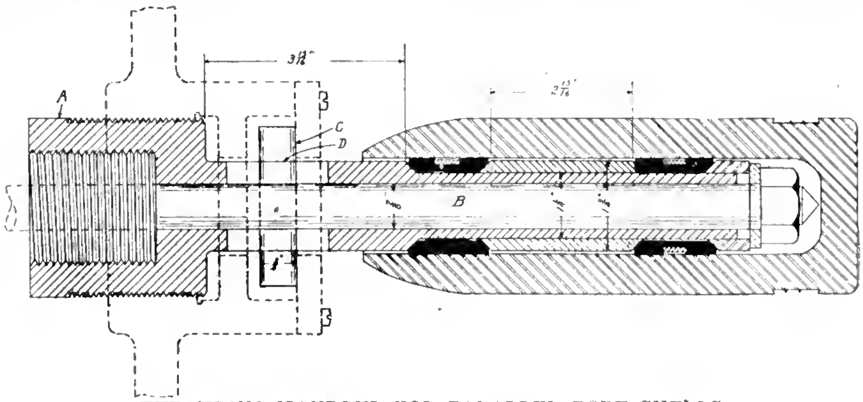
By E. T. Spidy

AS many of your readers are aware, the manufacture of munitions has called for much originality in designing tools and fixtures, partly because of the necessity of converting regular lines of machines which were adapted for work of a different nature, and partly because of the hurry in which they have had to be put into service.

One of the most called for pieces of mechanism at the present time is the expanding mandrel and every shop has its own variety to meet its particular requirements. It is a well-known fact that long holes are often not perfectly straight, particularly after the drill becomes worn. This may be accounted for in that a drill may strike a hard spot in the material and thereby glance a few thousandths of an inch to one side.

The mandrel illustrated was designed to average up the hole so that a "mean" along the total length would be obtained. It consists of a body A, which is threaded to suit the machine spindle. The body is bored out parallel and a spindle B, is fitted closely to its bore. At the lathe spindle end a cotter C is fitted through this spindle and corresponding slots D are milled in the body to allow for the travel of the cotter to tighten or slacken off the mandrel. On the outside of the body on the end inserted in the job, two steel sleeves are fitted and then split into three pieces. These three sections are held together by a retaining spring placed in groove shown for that purpose. Between these split sleeves a solid sleeve is placed which acts as a spacing block and also transmits the power applied by the centre spindle, through the nut and end bushing. It can be seen that when the spindle is moved towards the lathe spindle all the taper faces act in unison but do not tighten up until both split sleeves are engaged in the hole. Thus a hole tapered in either direction, or a hole out of line in any direction is held rigidly and at an average trueness. Any user of mandrels will appreciate this advantage because the style of mandrel in common use presses out the dogs in such a way that only a parallel hole is held along its total length solidly in such a manner that will produce accurate work.

The manner of tightening the mandrel into the job must be adopted according to the work requirements and the machine. For centreing purposes it is sufficient to attach a hand lever to directly engage the cotter, while for heavy turning in a lathe with a hollow spindle it is necessary to extend the spindle through the headstock and to attach a handwheel and a screw on the end of the lathe headstock and to attach a handwheel and a screw on the end of the lathe headstock.



EXPANDING MANDREL FOR PARALLEL BORE SHELLS.

When the lathe has no hollow spindle and heavy duty is required, the body of the mandrel may be threaded on the outside over the part screwed on to the lathe spindle and a handwheel threaded to fit this thread. The boss on the other side of the handwheel is extended to reach the cotter and a plate fitted over same so that the cotter is free to travel up the mandrel with the motion of the wheel in the recess so formed. This latter method is the most simple to apply and is entirely successful in operation.

Expansion joints should be located in all approximately straight pipe lines at such intervals that the extreme change in the length of pipe will not exceed the safe travel or range of the expansion element and that the force or strain exerted in moving the length of pipe may not be excessive and start leakage.

Large Shells: Production Problems and Possibilities--I.

By C. T. D.

In preparing to undertake the production of large shells up to 9.2 in. dia., manufacturers will encounter problems of a nature altogether different from those connected with 18 pdr. shells. Automatic machinery will not be so applicable to the larger sizes, and productive ability will centre largely on such points as sequence of operations, tooling methods, etc.

IN undertaking the production of large shells up to 9.2 in. diameter, Canadian manufacturers will find considerable opportunity for utilizing all the experience obtained in making the smaller sizes, while at the same time many important differences, both in design and size, will be found which will require just as careful planning and carrying out as any of the initial problems encountered in shrapnel manufacture.

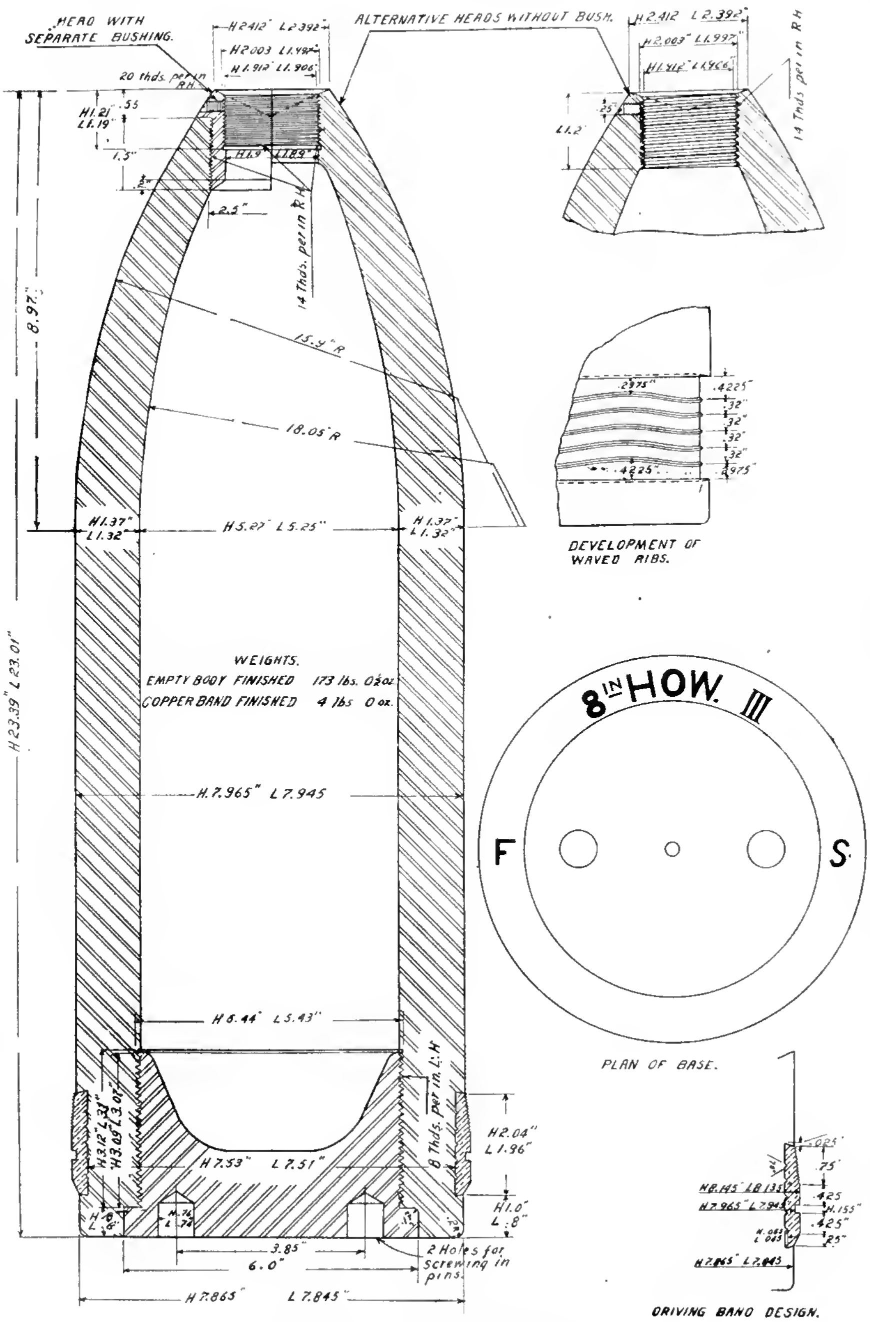
In producing shrapnel, difficulties were met which were peculiar to that type of shell, due to certain features of design and physical requirements. Buckling of the nose and walls, variations in heat treatment for different brands of steel, excessive wear on taps and tools due to irregularities in physical properties of the metal and so forth are some of the more familiar troubles which have been experienced by almost all producers of shrapnel.

The advent of high explosive 18 pdr. and 4.5 shells removed most of those previous troubles, to be succeeded by those incident to the insertion of the base plug, though the choice between a plain plug with a peined joint, and a threaded plug offers an alternative which has certain desirable features.

A study of the drawings of forgings and finished shells, which we reproduce, shows certain variations which will determine to a considerable degree the procedure adopted by different makers.

The various sizes of shells may be divided into two main groups, viz., solid base, and open base. The 60 pdr. and the 6 in. shell belong to the first group, while 8 in. and larger form the second.

Considering the solid base designs, the inserted disc in the base is common to both the 60-pounder and the 6-inch. The use of threaded discs or plugs although more costly than the plain system, is preferred by many manufacturers because of the smaller possibility of rejections. In order to ensure contact over the entire surface of the disc, it is made slightly convex so that when tightened up, the contact commences in the centre and spreads over the surface as the thread tightens.



8-INCH HIGH EXPLOSIVE SHELL.

The special machines now available insure the production of perfect threads and a satisfactory job with ordinary care.

In the case of plain discs, these are made a fairly close fit, allowing for escape of imprisoned air. The outer edge is bevelled slightly and a ridge or bead left on the mouth of the hole is riveted over. The riveting gradually draws the plate down flat after which a finishing cut removes all traces of the operation.

The bore of the 60-pounder shell closes in at the mouth, necessitating nosing in, while the 6-inch shell is made with a parallel bore, the lower face of the socket being well hollowed out to form an approximately hemispherical upper end of the interior. In the event of a shortage of steel bushings, makers might be called upon to supply 60 pdr. shells with solid bushings, as has been done in some cases with 4.5 shells. The reduced size of boring bar and increased overhang of cutting tool are serious handicaps when finishing internal profile in this case.

The principal remaining difference is in the design of driving band. In addition to being more complicated in profile, the 6 in. band is featured with an undercut which calls for increased care in production and also in handling.

The principle of construction adopted in these shells is radically different from

that of the 6 in. size and under.

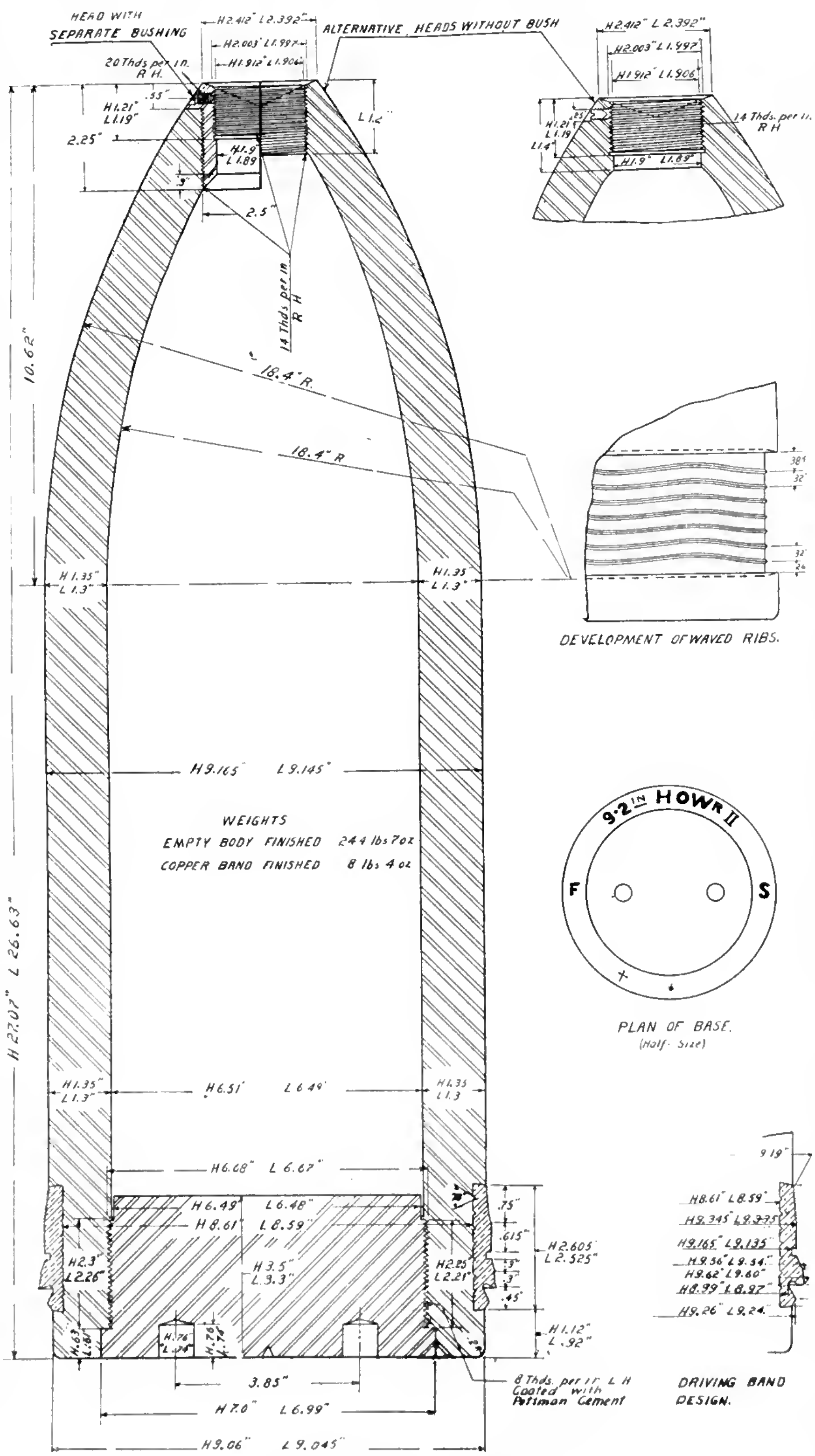
8-in. and 9.2-in. Shells

In place of being made with a solid base and open-mouth necessitating a nosing operation, etc., these shells are forged with the nose closed or solid, and the base open. A solid forged steel plug with ample length of thread renders it possible to make a perfectly sound gas-tight joint, capable of withstanding the intense heat and pressure of the exploded gases.

The first question which presents itself to the practical mind is that of machining the bore of the shell. Machines for performing this operation have been in use in the regular arsenals and munition factories right along, but the private firms undertaking this work for the first time will in most cases develop their own ideas, as in the case of the smaller shells. Methods of machining open base shells will develop round the manner of boring. In one case the shell will revolve and boring bars and cutters will be fed into it in the conventional manner. In the other case, the shell will be held rigidly in a cradle and fed on to a revolving cutter bar.

In either case the best way to start is to work from the inside of the shell outward. It may not appear so to all, and it may not be compatible with certain methods and systems of machining, but those makers who are not yet committed to a definite method should bear in mind the fact that just as these shells are bigger than 18 pounders, so will their variations in the rough state be greater. A much quicker approach to the required degree of accuracy can be obtained by locating all operations from the inner surface of the shell as inequalities in the thickness of metal can be anticipated and removed more conveniently and effectively with a turning tool on the outside, than with a more or less yielding boring bar working out of sight.

The question of whether to make a separate or solid bushing is a matter for individual judgment on the part of the maker. If sufficient space is obtained without the bush then a slight saving in tap expense and time of machining is possible, coupled with the reserve possibility of enlarging the hole and using a bush should the first hole be spoiled in threading. A further consideration would be the non-liability to delay through the non-delivery of bushings from firms engaged in their manufacture.



9.2 INCH HIGH EXPLOSIVE SHELL.

It is perhaps desirable that the base plugs be made in the same shop as the shells. The making of these in separate establishments is quite in accordance with modern machine practice, provided gauges of close enough limits are used and care is taken to avoid damage to threads and surfaces in shipment and handling. The allowable limits on the thread diameters are generous and while supplied plugs might be just within limits in one direction, the shell might be just as close to the limits in the other direction, consequently trouble would arise in one case getting the plug into the shell, and in the other, getting the shell past the inspector.

By producing the plugs in the same shop as the shell, more satisfactory work can be accomplished, as once having determined on a no-limit size for the plug, all available limits can be taken advantage of in tapping the end of the shell.

Driving Bands

A considerable difference in profile between 8 in. and 9.2 in. bands exists, and in the absence of any obvious reason or official explanation, the requirements have simply to be fulfilled. As in the 6 in. shell, the 9.2 in. band is shown having an undercut which does not simplify matters. The numerous vee grooves call for particular care not only in machining but in securing properly annealed copper so as to produce perfect outlines. Banding presses of greatly increased power are necessary in view of the increased dimensions of the band.

The assembling of the plugs offers op-

portunities for the development of plug driving machines for tightening plugs by power assuring efficient and uniform results.

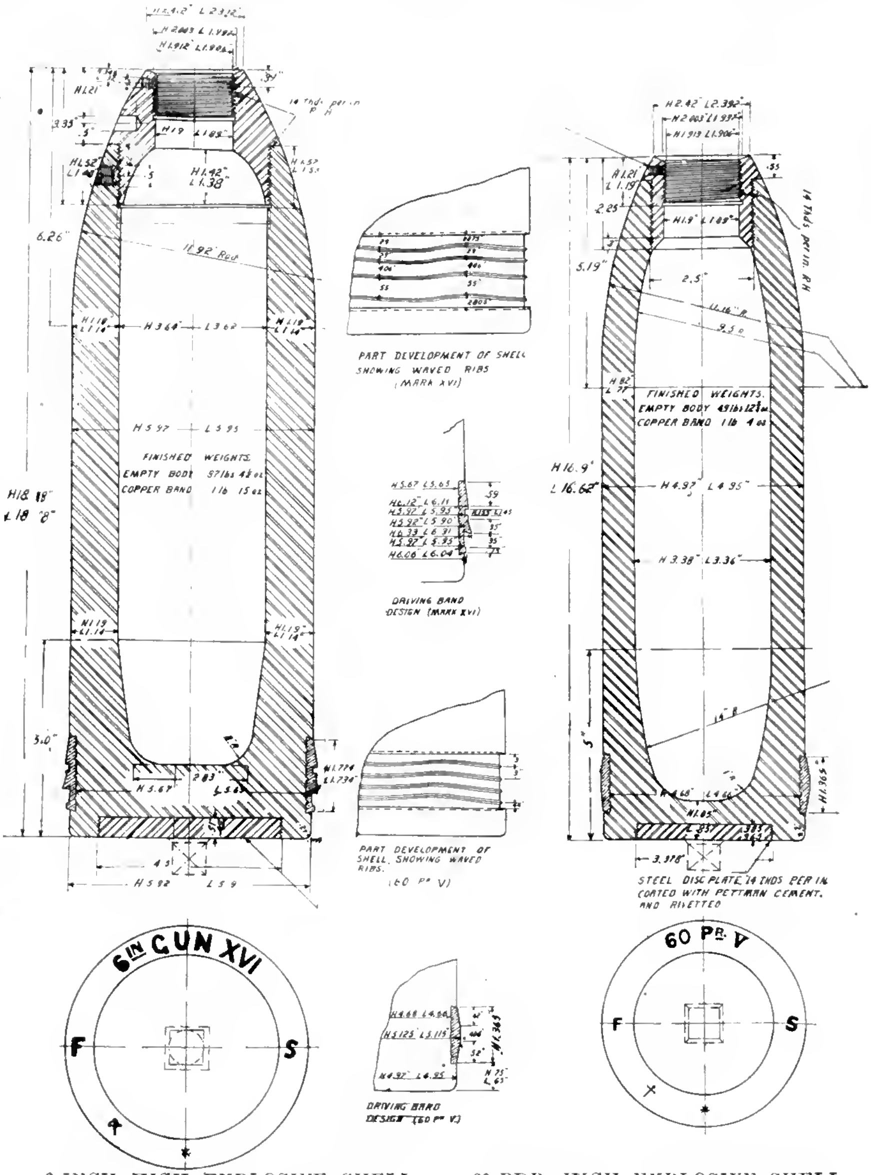
Not the least important of equipment developments lies in the necessity for power handling apparatus.

Prospective makers of these large shells will be well advised to approach the driving band feature with all possible deliberation and care. The great increase in size, as well as the intricacy of outline, makes it an entirely different proposition from 18-bands. The band profile of the smaller shells is comparatively simple, and the circumference about one-third that of the big bands, both of which facts conduce to a large output in numbers from a single set of forming tools.

Whether the present methods of band turning will be entirely satisfactory on these large bands is a point that can best be decided from actual experience. The possibility of developing a special profile miller seems not altogether remote, and from a theoretical standpoint offers certain advantages. Revolving a heavy forging at a high rate of speed in order to remove a small quantity of metal from a minor component is bad practice, not only from a power saving point of view, but from quality of production as well. Constant attention would be necessary to prevent heating up the steady rest, and any seizing of the shell with consequent scoring might easily cause enough damage to result in rejection. This fact alone would justify consideration being given to the use of a milling machine in which the heavy shell body would be revolved slowly while a formed milling cutter produces the profile on the band.

Several developments of design suggest themselves such as a multiple spindle milling device in which a roughing cutter fed into the work in front would remove the surplus stock and a sizing cutter behind would be elevated on a vertical slide till it was level with the centre of shell. If cutting compound had to be used to prevent the finer portions of profile from tearing, a copious stream would prevent heating of the band from spreading much beyond the parts being operated on.

The provision of a suitable tool with angular feed to undercut the band would seem necessary although it is more than probable that the fresh angle of attack, from which many of our manufacturers will approach these problems, will result in not a few ingenious and original methods and devices being produced.



6-INCH HIGH EXPLOSIVE SHELL. 60-PDR. HIGH EXPLOSIVE SHELL.

Threading the plug also offers opportunities for milling applications, possibly the tapping of the shell itself may be treated in this way.

Handling Apparatus

The increased weight of these large shells, both rough forged and machined, necessitates changes of a very radical nature in the ways and means of handling them not only in and out machines, but in course of transportation from one part of a factory to another.

From the time a forging commences to undergo the first operation until it is completed, or until a break in its progress is advisable, say at the banding press or enamelling oven, all its steps should be strictly in rotation so as to avoid any doubling on its tracks.

Where it is possible to do so, an overhead track, with travelling chain blocks or hoists, either air, electrical, or otherwise, will prove the most popular and efficient method.

Circumstances peculiar to certain shops may render preferable the adoption of small revolving jib cranes on each machine which would require the use of suitable transfer trucks for moving between operations. A well thought out arrangement of this nature might be much less costly and when properly used, just about as quick as an overhead track. Any doubling back that might be necessary on occasion would certainly cause little if any confusion with this system as compared with a track which would not allow movement in either direction when a job was being set up in a machine.

The production of forgings up to the 8-in. size is now an accomplished fact in this country, although some few weeks must elapse before 9.2-in. forgings are also in course of production. Reproductions of forging drawings which give a good idea of the probable amount of work which will be required and the detailing of different methods, with illustrations and descriptions of the machines and tools for use therewith will form the subject of future articles in these columns.

Bombs Made in Canada.—Bombs have been added to the munitions products which Canada is now producing for the British War Office. An order for 5,000 of these projectiles has been received by the commission, and is being placed for speedy delivery. The bombs are to be used in trench warfare, and are to be fired from what are known as mine or trench guns.

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ANTICIPATING RESUMPTION OF PEACE-TIME BUSINESS

APPARENTLY of equal moment and importance to the manufacture of war munitions—perhaps even transcending the latter, is the manufacture of industrial stock values. From week to week these continue to advance, not seldom by leaps and bounds, and the question is naturally being asked: what is going to happen them when the end of the war becomes imminent?

Undoubtedly our steel and metal-working industries are finding munitions production worth while, but we hesitate to believe that the margin between contract prices and production costs is anything like so great as to justify the high level attained by the stocks. The impression has got abroad that our manufacturers are making huge profits on war orders, and that the war is being made the medium whereby a multiplicity of individual and corporate enrichment may be brought about. In any case, "It's an ill wind that blows nobody any good." Therefore, in spite of the devastating influences of and distress caused by this war of wars, a considerable number of people, here and elsewhere, will no doubt realize a bountiful harvest of hard cash by devious means and channels. Combat their doing so how we may, such a consummation will be inevitable.

It is generally conceded, and at first sight reasonably so, that, after the necessarily long period of neglect, much constructional leeway will have to be made up. The expectation then is that a burst of prosperity such as we have probably never known, will so efface the transition from war to peace that neither stock prices nor productive activities will be affected.

A boom is predicted in merchant shipbuilding to make good the losses by sinking, and to compensate for the almost total extinction of vessel construction in Britain. A similar boom is predicted in the sphere of railroad betterment, to compensate again for the long period during which maintenance has been neglected and earnings conserved. Development work of every description, private, municipal and Governmental, is, we are told, to be no exception; thus, on paper, the end of the war seems to be desirable for a variety of reasons.

In all calculations or prophesies of the nature of the foregoing, no cognizance, however, is taken of the price we are having and will have to pay for the war. We forget that in addition to war stocks reaching giddy heights, material and labor, and all else have pyramided. Stock market prices have a knack of crashing down en masse when the opportune moment arrives; not so these others.

Steel, wages, food and clothing are largely interdependent and have a comprehensive application. They are usually super-sensitive to the upward turn, and during the past year have proved so on many occasions. Individually or collectively they are less sensitive to the downward tendency, be the latter of simple desire or judiciously applied force or pressure. The downward movement is not only hard to start, but is so slow and gradual as to be almost imperceptible of measurement.

With the end of the war in sight, attention will, as already indicated, be turned to the peace-time pursuits of shipbuilding, railroading, etc. It will be found, however, that shipowners, railroad executives, etc., continue to sit tight so far as the distribution of orders is concerned, the cost of raw and finished material for the purposes of their requirements being totally prohibitive from the standpoint of the then or immediately prospective earnings. War-time prices for equipment and supplies will match ill with peace-time revenue. A period of readjustment must needs be ushered in, during which business of every description will incline to languish, war stocks will disappear and plain industrials will take their place. Prices of raw and finished material will have to be marked down, however slowly and reluctantly those involved contribute to the process.

Only by producers and their help getting together now, without waiting for the end of the war to become more imminent, and planning the necessary and inevitable procedure when the time is ripe, will the transition period be shortened and perchance eliminated, and a prolonged and wholly unnecessary business depression be avoided. Capital and labor are equally interested in the matter and both will be called upon to make big concessions sooner or later. The general welfare of our people demands that they take time by the forelock and arrange the details now.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey forge, Pittsburgh	$15 45	
Lake Superior, charcoal, Chicago	16 75	
Ferro nickel pig iron (Soo)	25 00	
	Montreal.	**Toronto.**
Middlesboro, No. 3	$24 00	.....
Carron, special	25 00	.....
Carron, soft	25 00	.....
Cleveland, No. 3	24 00	.....
Clarence, No. 3	24 50	.....
Glengarnock	28 00	.....
Summerlee, No. 1	30 00	.....
Summerlee, No. 3	29 00	.....
Michigan charcoal iron	28 00	.....
Victoria, No. 1	24 00	21 00
Victoria, No. 2X	23 00	21 00
Victoria, No. 2 plain	23 00	21 00
Hamilton, No. 1	23 00	21 00
Hamilton, No. 2	23 00	21 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	**Cents.**
Common bar iron, f.o.b., Toronto	2.50
Steel bars, f.o.b., Toronto	2.50
Common bar iron, f.o.b., Montreal	2.50
Steel bars, f.o.b., Montreal	2.50
Twisted reinforcing bars	2.55
Bessemer rails, heavy, at mill	1.25
Steel bars, Pittsburgh	1.60
Tank plates, Pittsburgh	1.60
Beams and angles, Pittsburgh	1.60
Steel hoops, Pittsburgh	1.75
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.50
Small shapes	2.75
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	2.20
Structural shapes	2.20
Plates	2.20

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal	Toronto
Plates, ¼ to ½ in., 100 lb.	$2 35	$2 35
Heads, per 100 lb.	2 60	2 60
Tank plates, 3-16 in.	2 70	2 70

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$12 75	$12 75
Copper, crucible	15 25	15 00
Copper, unch-bled, heavy	14 75	14 50
Copper, wire, unch-bled	14 75	14 50
No. 1 machine compos'n	11 75	11 75
No. 1 compos'n turnings	10 25	10 00
No. 1 wrought iron	10 00	8 50
Heavy melting steel	9 00	9 00
No. 1 machin'y cast iron	13 50	12 50
New brass clippings	11 00	11 00
No. 1 brass turnings	9 00	9 00
Heavy lead	5 00	5 00
Tea lead	$ 4 00	$ 4 00
Scrap zinc	12 50	11 00

W. I. PIPE DISCOUNTS.

Following are Toronto jobbers' discounts on pipe in effect Nov. 5, 1915:

	Buttweld Black Standard	Gal.	Lapweld Black	Gal.
¼, ⅜ in.	62	38½	....	....
½ in.	67	47½	....	....
¾ to 1½ in.	72	52¼	....	....
2 in.	72	52½	68	48½
2½ to 4 in.	72	52½	71	51½
4½, 5, 6 in.	....	....	69	49½
7, 8, 10 in.	....	....	66	44½
X Strong P. E.				
¼, ⅜ in	55	38½	....	....
½ in	62	45½	....	....
¾ to 1½ in.	66	49½	....	....
2, 2½, 3 in.	67	50½	....	....
2 in.	....	....	62	45½
2½ to 4 in	....	....	65	48½
4½, 5, 6 in.	....	....	65	48½
7, 8 in	....	....	58	39½
XX Strong P. E.				
½ to 2 in	43	26½	....	....
2½ to 6 in.	....	....	42	25½
7 to 8 in.	....	....	39	20½
Genuine Wrot Iron.				
⅜ in	56	32½	....	....
½ in	61	41½	....	....
¾ to 1½ in.	66	46½	....	....
2 in.	66	46½	62	42½
2½, 3 in.	66	46½	65	45½
3½, 4 in.	....	....	65	45½
4½, 5, 6 in.	....	....	62	42½
7, 8 in.	....	....	59	37½

Wrought Nipples.

4 in. and under	77½%
4½ in. and larger	72%
4 in. and under, running thread	57½%

Standard Couplings.

4 in. and under	60%
4½ in. and larger	40%

MILLED PRODUCTS.

Sq. & Hex Head Cap Screws	65 & 5%
Sq. Head Set Screws	70 & 5%
Rd. & Fil. Head Cap Screws	45%
Flat & But. Head Cap Screws	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in.	70%
Semi-Fin. Nuts up to 1 in.	70%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

METALS.

	Montreal.	Toronto.
Lake copper, carload	$20 00	$20 50
Electrolytic copper	20 00	20 25
Castings, copper	19 25	20 00
Tin	45 00	48 00
Spelter	19 00	19 00
Lead	6 50	7 00
Antimony	40 00	40 00
Aluminum	62 00	65 00

Prices per 100 lbs.

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh	$26 00
Open-hearth billets, Pittsburgh	28 00
Forging billets, Pittsburgh	45 00
Wire rods, Pittsburgh	35 00

NAILS AND SPIKES.

Standard steel wire nails, base	$2 60	$2 55
Cut nails	2 50	2 70
Miscellaneous wire nails	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	70
Stove bolts	80
Plate washers	40
Machine bolts, ⅜ and less	65
Machine bolts, 7-16 and over	50-7½
Blank bolts	50-7½
Bolt ends	50-7½
Machine screws, iron, brass	35
Nuts, square, all sizes	3¾c per lb off
Nuts, hexagon, all sizes	4¼c per lb. off
Iron rivets	72½
Boiler rivets, base, ¾-in. and larger	$3.75
Structural rivets, as above	3.75
Wood screws, flathead, bright	85, 10, 7½, 10 p.c. off
Wood screws, flathead, brass	75 p.c. off
Wood screws, flathead, bronze	70 p.c. off

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong. Sizes Ins.	Price per ft.	D. Ex. Strong. Size Ins.	Price per ft.
⅛in	$.05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1¼in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	....
7 in	2.38	7 in	3.81	....	....
8 in	2.50	8 in	4.34	....	....
8 in	2.88	9 in	4.90	....	....
9 in	3.45	10 in	5.48	....	....
10 in.	3.20	....	....	....	....
10 in.	3.50	....	....	....	....
10 in.	4.12	....	....	....	....

COKE AND COAL

Solvay Foundry Coke	$6.25
Connellsville Foundry Coke	5.65
Yough Steam Lump Coal	3.63
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

COLD DRAWN STEEL SHAFTING.

At mill	30%
At warehouse	20%

Discounts off new list. Warehouse price at Montreal and Toronto.

MISCELLANEOUS

Solder, half-and-half	0.25
Putty, 100-lb. drums	2.70
Red dry lead, 100-lb. kegs, per cwt.	9.65
Glue, French medal, per lb.	0.15
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.23½
Benzine, single bbls., per gal.	0.23
Pure turpentine, single bbls.	0.85
Linseed oil, raw, single bbls.	0.85
Linseed oil, boiled, single bbls.	0.88
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.50
Lead Wool, per lb.	0.11
Pure Manila rope	0.16
Transmission rope, Manila	0.20
Drilling cables, Manila	0.17
Lard oil, per gal	0.73
Union thread cutting oil	0.60
Imperial quenching oil	0.35

POLISHING DRILL ROD

Discount off list, Montreal and Toronto 40%

PROOF COIL CHAIN.

¼ in.	$9.00
5-16 in.	5.90
⅜ in.	4.95
7-16 in.	4.65
½ in.	4.40
9-16 in.	4.05
⅝ in.	4.30
¾ in.	4.15
⅞ inch	3.65
1 inch	3.45

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	55
Carbon over 1½ in.	25
High Speed	
Blacksmith	55
Bit Stock	60 and 5
Centre drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Centre	25
Pipe Reamers	80

Discounts off standard list.

IRON PIPE FITTINGS.

Canadian malleable, A, 25 per cent.; B and C, 35 per cent.; cast iron, 60; standard bushings, 60 per cent.; headers, 60; flanged unions, 60; malleable bushings, 60; nipples, 75; malleable, lipped unions, 65.

TAPES

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3.50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$3 30	$3 00
Canada plates, dull, 52 sheets	3 15	3 15
Canada Plates, all bright	4 60	4 75
Apollo brand, 10¾ oz. galvanized	5 50	4 80
Queen's Head, 28 B.W.G.	6 00	5 95
Fleur-de-Lis, 28 B. W. G.	5 75	5 75
Gorbal's Best, No. 28	6 00	6 00
Viking metal, No. 28	5 25	5 25
Colborne Crown, No. 28	5 70	5 80
Premier No. 28	5 40	5 20

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$14 25	.....
1¼ in.	15 00	.....
1½ in.	15 00	.....
1¾ in.	15 00	.....
2 in.	15 00	.....
2¼ in.	16 50	9 25
2½ in.	17 50	10 50
3 in.	25 00	12 25
3½ in.	28 00	14 50
4 in.	33 00	18 50

Prices per 100 feet, Montreal and Toronto.

WASTE.

WHITE.	Cents per lb.
XXX Extra	0 11½
X Grand	0 11
XLCR	0 10¼
X Empire	0 09½
X Press	0 08¾
COLORED.	
Lion	0 07¾
Standard	0 07
Popular	0 06¼
Keen	0 05½
WOOL PACKING.	
Arrow	0 17
Axle	0 12
Anvil	0 09
Anchor	0 07
WASHED WIPERS.	
Select White	0 08½
Mixed Colored	0 06¼
Dark Colored	0 05¼

This list subject to trade discount for quantity.

BELTING RUBBER

Standard	50%
Best grades	30%

BELTING—NO. 1 OAK TANNED.

Extra heavy, single and d'ble,	40 & 10%
Standard	50%
Cut leather lacing, No. 1	$1.20
Leather in sides	1.10

ELECTRIC WELD COIL CHAIN B.B.

⅛ in.	$12.75
3-16 in.	9.00
¼ in.	6.00
5-16 in.	4.75
⅜ in.	3.75
7-16 in.	3.75
½ in.	3.75
⅝ in.	3.60
¾ in.	3.60

Prices per 100 lbs.

PLATING CHEMICALS

Acid, boracic	$ .15
Acid, hydrochloric	.05
Acid, hydrofluoric	.06
Acid, nitric	.10
Acid, sulphuric	.05
Ammonia, aqua	.08
Ammonium carbonate	.15
Ammonium chloride	.11
Ammonium hydrosulphuret	.35
Ammonium sulphate	.07
Arsenic, white	.10
Copper sulphate	.10
Cobalt sulphate	.50
Iron perchloride	.20
Lead acetate	.16
Nickel ammonium sulphate	.10
Nickel carbonate	.50
Nickel sulphate	.15
Potassium carbonate	.40
Potassium sulphide (substitute)	.20
Silver chloride (per oz.)	.65
Silver nitrate (per oz.)	.45
Sodium bisulphite	.10
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.35
Sodium hydrate	.04
Sodium hyposulphite (per 100 lbs.)	3.00
Sodium phosphate	.14
Tin chloride	.45
Zinc chloride	.20
Zinc sulphate	.07

Prices Per Lb. Unless Otherwise Stated.

ANODES

Nickel	.47 to .52
Cobalt	1.75 to 2.00
Copper	.22 to .25
Tin	.45 to .50
Silver	.55 to .60
Zinc	.22 to .25

Prices Per Lb.

PLATING SUPPLIES

Polishing wheels, felt	1.50 to 1.75
Polishing wheels, bullneck.	.80
Emery in kegs	.4½ to .06
Pumice, ground	.05
Emery glue	.15 to .20
Tripoli composition	.04 to .06
Crocus composition	.04 to .06
Emery composition	.05 to .07
Rouge, silver	.25 to .50
Rouge, nickel and brass	.15 to .25

Prices Per Lb.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., Nov. 15, 1915.—Favorable industrial conditions continue throughout the Dominion. In the iron and steel trades, the activity is quite unparalleled, and the possibilities are that the immediate future may see even greater developments.

The manufacture of steel promises to crowd the capacity of every mill both in Canada and the United States. In this connection it is interesting to note that one hundred years ago the United States were producing about 50,000 tons of pig iron a year, while the average daily output for October last was over 100,000 tons, or an increase of 600 to 1.

The pressure being felt by the steel mills is largely due to the demand for war supplies, not only in shell bars and billets, but in many other lines, such as steel rails, structural steel for cars, locomotives, automobiles and the countless necessities used, directly, or indirectly, for the maintenance of large armies in the field.

Previous to the breaking out of hostilities, Canada as well as other countries countries, was purchasing large quantities of chemicals from Germany. Brought face to face with the problem of supplying their own needs, or paying prohibitive prices for what little could be obtained, the Canadian chemists have not only succeeded in accomplishing remarkable results in the production of these much-needed chemicals for their own use, but are able to export to Britain.

Enlarged opportunities have been opened for Canadian manufacturers, not only for supplies relative to war munitions, but in all classes of trade, formerly monopolized by European nations.

Steel.

The steel trade continues at quite high pressure, every available mill working to the limit, in the endeavor to supply the abnormal demand for bars and billets, as well as to keep up with the gradually increasing commercial requirements. The stress placed upon the steel-producing plants on this continent is shown by the past week's reports, in which it is stated that the United States Steel Corporation have withdrawn all prices on steel products except tubes and pipes. They are practically out of the market on all other lines of steel. Delivery under nine months is almost impossible, and many plants are closing down on future orders, until they can state definitely their exact position.

The requirements of the finishing mills are beyond the output of crude steel, and one of the necessities of the moment is to bring the production of the basic material up to the output of the rolling mills.

Canadian furnaces are only producing about one-half of the steel being used by our manufacturers, and any restriction placed upon importation would have a serious effect meantime.

Construction of large additions to the plant of the Nova Scotia Steel Co. are now being undertaken, and within three months new furnaces are expected to be in operation, producing 200 tons a day in addition to their present output. New equipment for the production of the larger shells is also to be delivered at New Glasgow in about six weeks. The mines in connection with this company will continue operations at high pressure throughout the winter months.

> **CANADIAN GOVERNMENT PURCHASING COMMISSION**
>
> **The following gentlemen constitute the Commission appointed to make all purchases under the Dominion $100,000,000 war appropriation:—George F. Galt, Winnipeg; Hormidas Laporte, Montreal; A. E. Kemp, Toronto. Thomas Hilliard is secretary, and the commission headquarters are at Ottawa.**

Machine Tools and Supplies.

Activity in machine tools has received a new impetus because of the expectation that many firms will receive orders for the heavy type of explosive shell, as well as additional orders for the present shells of 3.3. and 4.5-inch type. Many inquiries have come in for machines suitable for the production of 6-in., 8-in. and 9.2-in. shells, and in a short time definite information may be received as to the successful firms receiving contracts for additional munitions.

The demand for supplies is as heavy as ever. The munition factories are working night and day, and small tools and other supplies are a constant requirement.

Metals.

The present situation in the metal market is little changed from that of the preceding week. However, the reported closing of the Suez Canal has created some excitement among buyers of spot tin with the result that the persistent buying to cover requirements has advanced the price from 38c to 45c a lb.

Copper is showing some signs of improvement, but last week's quotations prevail. Spelter is a shade stronger, and is quoted at 19c, and antimony shows an advance of five dollars per 100 lbs. A slight increase is noted in aluminum, a price of 62c being now quoted.

Copper.—The optimistic outlook for future copper is keeping the market firm. Although foreign quotations show advances, prices locally remain steady.

Tin.—Conditions in the Far East have apparently clouded the tin situation for the present, with the result that heavy advances have been made on prices for spot tin. Any losses of spot tin now in process of transportation might easily cause a further advance. This week's quotation shows an increase of $7 per 100 lbs. over that of last week.

Spelter.—Foreign advances in the price of spelter have not affected the local market very much. However, an advance of one cent per lb. is shown in this week's prices.

Lead.—This continues firm at 6½c per lb.

Antimony.—The apparent scarcity developing in antimony and the demand has made the price stronger, the present quotation being $40 per 100 lbs.

Old Materials.

Business in scrap metals of all kinds has been fairly brisk during the past week, and a general advance is noted in many lines. Copper has advanced about $10 a ton, considerable quantities being handled.

Business in heavy melting steel has increased the price ½c per pound.

Heavy melting lead has risen to $5 per 100 lbs., and tea lead shows an increase of ¼c per pound. Scrap zinc is selling at 12½ cents.

Toronto, Ont., Nov. 16.—The recent action of the United States Steel Corporation with regard to the Canadian market shows conclusively the far-reaching effect which the war is having on the steel trade here and elsewhere. The situation has been caused entirely by the enormous demand for munitions which will increase now that the orders for the large calibre shells are being placed. No official list of successful tenderers will be given out, nor the size of the orders named, notwithstanding reports to the contrary. This is the wish of the British War Office, which has notified the shell Committee to that effect. It is understood that some orders for 6-in. shells have already been placed and that the contracts for the larger shells, although not actually signed up, are practically assured to certain firms.

The general industrial situation is gradually improving and a more confident spirit prevails as a result. A large

number of factories are engaged in the production of war equipment and the engineering trade is active on shell orders. Prices of all lines have a higher tendency, particularly iron and steel products, which continue to advance. The metal market is very active and a general advance in prices has to be noted.

Steel Market

The recent announcement issued by the United States Steel Corporation is of considerable importance to Canadian steel plants. The Corporation in addition to withdrawing prices to the Canadian trade, have decided not to solicit business in this market until conditions have become normal. This order will affect principally bars and billets, etc., for which there is such a heavy demand; structural shapes will also be affected. This action of the Corporation does not mean that they will refuse business, providing delivery is no object, or that orders already booked will not be filled. It is simply a question of delivery. The demand is so far ahead of production that the output of the mills is booked up for several months in advance. Under these conditions and with unfilled tonnage increasing each month, prices cannot be fixed so far ahead and no promise can be made to consumers when they are likely to get delivery. The situation thus revealed is unprecedented and while not particularly serious at present may become so as the demand for steel for munitions continues to in increase and present contracts run out. The market is naturally upset and the outlook is uncertain.

Canadian steel companies, although operating on capacity, are falling behind in meeting the demand, and higher prices for steel products are inevitable. The prosperity of the steel industry is assured for some time to come and plants will have to be extended to take care of the demand. It is announced that the Nova Scotia Steel Co. will build an open-hearth furnace having a capacity of 200 tons per day. The same concern will install new presses for forging 8-in., 9.2-in. and 12-in. shells, also the necessary machining equipment.

Prices continue in an upward direction. Canadian mills are now quoting bars at 2.50c base, and reinforcing bars 2.35c base Toronto, plus extra for twisting. Steel bars are 2.50c and small shapes 2.75c f.o.b. Toronto warehouse. Pittsburgh bars, plates and shapes for Canadian consumption are quoted at 1.60c, but this figure is practically nominal, as no orders are being booked. Seamless boiler tubes have advanced again, but lapwelded are unchanged for the present. Higher prices on tubes are expected. Boiler plates are very firm and an advance in price may be made early next month. Some lines of bolts and nuts have advanced, the new discounts being as follows: Coach and lag screws, 70 p.c.; machine bolts, 3/8 in. and less, 65 p.c.; machine bolts, 7-16 in. and over, 50 p.c.; blank bolts and bolt ends, 50 and 7½ p.c.; square nuts, 3¾c per lb. off, and hex. nuts 4½c per lb. off. Another advance in wrought iron pipe has been made and is now in effect. The new schedule affects black pipe only, galvanized remaining unchanged.

Prices of high-speed tool steel continue to advance and the situation shows no improvement. The scarcity of tungsten has assumed serious proportions and the supplies, although increasing, are not sufficient to meet the demand. As this alloy to a large extent determines the price, quality and quantity of high-speed steel, it is apparent that while tungsten keeps at the present high level, high-speed tool steel will also be correspondingly high. The situation is further aggravated by the exceptionally heavy demand, which is at least five times that of normal.

Prices of all descriptions of steel sheets are very firm, and higher prices are expected. In galvanized sheets, the differentials between the gauges continue upset by the abnormal spelter situation, and while the consumer may secure heavy gauges at comparatively low prices, he must pay higher price for light gauges. Acid is becoming scarce and is high in price, and this, together with spelter and black sheets becoming more costly, will not doubt cause galvanized sheets to advance. Bessemer black sheets are quoted at 2.15c to 2.25c and open hearth 2.25c to 2.30c Pittsburgh.

In the States prices continue to advance, but this has had no effect in curtailing the demand, which is heavier than at any stage in this present movement. The unfilled tonnage of the United States Steel Corporation for October shows an increase of 847,000 tons over September. This record shows the development which is taking place in the market. The heavy demand for billets continues and prices are very firm. Wire rods are higher at $35 f.o.b. Pittsburgh.

ALLIES PURCHASING AGENTS

The Trade and Commerce Department, Ottawa, has published the following list of purchasing agents for military purposes for the allied Governments:

International Purchasing Commission, India House, Kingsway, London, Eng.

French.—Hudson Bay Co., 56 McGill Street, Montreal; Captain Lafoulloux, Hotel Brevort, New York; Direction de l'Intendence Ministere de la Guerre, Bordeaux, France; M. De la Chaume, 28 Broadway, Westminster, London.

Russian.—Messrs. S. Ruperti and Alexsieff, care Military Atache, Russian Embassy, Washington, D.C.

Pig Iron

The heavy demand for steel making pig iron continues but foundry grades are quieter. Prices are firm but unchanged.

Old Material

The market is considerably firmer and quotations higher for some metals. Copper is very strong and prices have advanced throughout the list. No. 1 machine composition and No. 1 composition turnings have advanced about 25c per 100 lbs., while No. 1 wrought iron and heavy melting steel are also higher. Prices of scrap lead are higher and scrap zinc is also advanced. Complete prices are given in the selected market quotations. Business is improving, but the higher prices are due more to the general buoyancy in the market and improved tone.

Machine Tools

The placing of the orders for the large-calibre shells is resulting in increased activity in the machine tool market. Quite a number of orders for tools, principally lathes, have already been placed and others are pending. Deliveries are better on the larger size lathes than on the smaller tools. Second-hand tools suitable for shell work are getting scarce and are not so easy to get hold of. Prices on all tools have advanced considerably. A feature of the present situation has been the development of the single-purpose lathe for which there is a big demand. Special tools for making shells have also been put on the market with exceptionally satisfactory results.

Supplies

A number of price changes have to be noted again this week. Solder, half-and-half, is higher at 25c, due to strength in the tin market. Prices of gasoline and benzine have been readjusted to bring gasoline ½c higher than benzine. Gasoline is now being quoted at 23½c and benzine at 23c per gallon, in barrels. A sharp advance has been made in turpentine, which is now quoted at 85c per gallon. Linseed oil is higher and is quoted at 85c for raw and 88c for boiled oil. Business continues brisk.

Metals

The market has revived and is more active. Prices of practically all metals have advanced, tin showing the greatest strength. The sharp advance of tin is

owing to a belief that the Suez Canal is closed and also on account of submarine activity in the Mediterranean. It is likely that shipments of tin will be interfered with on this account. Copper has advanced, and there is a better feeling in the market. Spelter, lead and antimony are all higher and the market is strong, while aluminum is higher and quotations nominal.

Tin.—Both London and New York markets are excited, buyers being anxious to cover their requirements, due to the report that the Suez Canal has been closed. If such is the case there will be a delay in getting supplies, while there is also a chance of shipments being lost in the Mediterranean on account of submarines. This scare, together with a spot scarcity, has unsettled the market. Tin has advanced 8c locally and is now quoted at 48c per pound.

Copper.—There is a better feeling growing in the market and the London market is stronger. There is no special improvement noted in the demand from consumers, but producers are confident that the latter must become heavy buyers soon. Copper has advanced 1c and is quoted at 20½c per pound.

Spelter.—The market is firm and higher. A corner in spot spelter has developed in London and quotations have advanced. Spelter has advanced 1c locally, and is quoted at 19c per pound.

Lead.—There is a shortage of supplies of spot and early delivery in London, and the market has advanced. The market is strong in New York and the "Trust" price is slightly higher at 5.15c which may be advanced. Locally, lead has advanced 1c and is quoted at 7c per pound.

Antimony.—The market is firm and there are indications of a scarcity in spot antimony developing if the demand for prompt metal continues as good as it has been during the week. Antimony has advanced 5c and is quoted at 40c per pound.

Aluminum.—The situation does not improve, and supplies are very difficult to obtain. Quotations have advanced 5c and are nominal at 65c per pound.

Moose Mountain Iron Mines at Sellwood, Ont., have closed down indefinitely after a series of disappointing experiments of the past several years to commercialize the immense bodies of ore which they control. The most recent experiments were with the Grondal system of concentrating and briquetting the ore for shipment to the blast furnaces, raising it from a 35 per cent. ore in the rock to a 60 per cent. in the concentrates, which was not a commercial success. It is estimated that over a million dollars has been expended by the Gates interests of New York and the Mackenzie and Mann interests of Toronto in this endeavor.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Toronto, Ont.—The Canadian Hanson & Van Winkle Co. are building a brass foundry at a cost of $5,000.

Galt, Ont.—The Perfect Machinery Co. will build a machine shop to cost $4,000. S. L. Clark is general manager.

Chatham, Ont.—Park Brothers of this city have closed a contract with the Dominion Sugar Co. for $14,300 worth of machinery for the new plant.

Berlin, Ont.—Louis F. Dietrich has purchased a property which will be converted into a garage. An elevator and other equipment will be required.

Hamilton, Ont.—The Canadian Chadwick Metal Co. are having the old Gompf brewery building altered and machinery installed for making munitions.

Waneta, B.C.—The Waneta Development Co. will immediately start construction of a hydro-electric power plant to be erected at the confluence of the Columbia and Pend O'Reille rivers, which will have a capacity of 80,000 h.p.

Toronto, Ont.—It is officially announced that the Ontario Hydro-electric Commission has completed the survey for a Government powerhouse to be erected between Queenston Heights and Niagara Falls, Ont. Plans are being prepared. It is planned to use the surplus waters of the Welland Canal to develop 300,000 h.p.

Electrical

Hespeler, Ont.—The Hydro Commission will install a new transformer and also a number of 100 c.p. nitrogen filled lamps.

Port Lambton, Ont.—A petition has been drawn up asking for the hydro-electric system to be extended to this town.

Agincourt, Ont.—This village is planning to secure connection with the Hydro-electric at Duncan, on the C. N. R., and it is understood the preliminary arrangements are all completed.

London, Ont.—By a vote of 65 to 8, the ratepayers of the village of Granton, fifteen miles north of here, on Nov. 9 carried a by-law authorizing the village council to enter into a contract with the Hydro-electric Power Commission for a supply of power.

Stratford, Ont.—The council and representatives of adjoining municipalities met Engineer Gaby and officers of the Provincial hydro-radial union and approved of the general plans of the main Toronto to London hydro-radial line as it affects Stratford and district. A motion was adopted that steps be taken to have necessary by-laws submitted to the electors in January.

Municipal

Hespeler, Ont.—The town council will call for tenders for a pumping station.

Guelph, Ont.—The installation of fire alarm system is being considered by the City Council.

Hamilton, Ont.—Fire Chief Ten Eyck has asked for a new fire alarm system to be installed.

Chatham, Ont.—Hydro power will probably be installed in the pumping station this year.

London, Ont.—The City Council contemplate further extensions to the waterworks distribution system.

Tecumseh, Ont.—A new water distribution system is contemplated for this town. The cost is estimated at $25,000.

Owen Sound, Ont.—The town council have decided to submit a by-law to the ratepayers to authorize a loan of $12,000 to W. A. Wilson, of London, who will start a shoe factory here.

Regina, Sask.—The City Commissioners have decided to install a new pumping unit driven by electrical power at Boggy Creek. The new pump will have a capacity of about two and a half million gallons. The cost is estimated at $12,000.

Toronto, Ont.—The Board of Control have received a dozen tenders for the construction of the new Don incinerator building exclusive of the new chimney. The prices ranged from $84,500 to $95,000, several being $86,000. The Controllers awarded the tender to George Welof, whose price was lowest at $84,500, subject to the approval of that Street Commissioner. The chimney will cost about $9,000.

General Industrial

Hespeler, Ont.—The Porcelain Kitchen Furniture Co. will establish a factory here shortly.

Petrolia, Ont.—Fred Howlett has purchased a site and intends to erect a brick and tile manufacturing plant.

Preston, Ont.—The Solid Leather Shoe Co. contemplate the erection of an addition to their factory. Manager, J. Parker.

Thorold, Ont.—The Ontario Paper Mill here was damaged to the extent of $2,000 by fire on November 9. The fire originated in the large bin which supplies the coal for the boilers. The loss is covered by insurance.

Tenders

Grand'Mere, Que.—Tenders are being received for the supply of one 500 h.p. turbine and dynamo. Engineer, L. S. Pariseau, Montreal.

Toronto, Ont.—Tenders will be received up to Tuesday, November 23rd, 1915, for the construction and erection of smoke breeching at main pumping station. Specifications and forms of tender may be obtained at the Works Department, Room 12, City Hall.

Halifax, N.S.—Tenders will be received by the Governor of the Province of Macao, up till January 8, 1916, for the supply of a steel, self-propelling dredges for the use of the Macao Harbor Works. Full particulars may be obtained at the office of Fred. H. Oxley, Consul for Portugal, Keith Bldg., Halifax, N.S.

Toronto, Ont.—Tenders will be received, addressed to the Chairman, Board of Control, City Hall, up to Tuesday, November 23rd, 1915, for the following: Asphalt, refined; brass and bronze castings; brass work for house services; bleaching powder; castings, pipe; castings, special; castings, manholes, etc.; general supplies; house numbers; hydrants; iron and steel; lead pipe; mineral dust; oils; rubber valves, etc.; stop valves. Specifications and forms of tender may be obtained at the Works Department, Room 12, City Hall.

Personal

Frank Chappell, town engineer of Oshawa, Ont., has resigned his appointment to accept a position with the McLaughlin Motor Co., Oshawa.

Wm. Weir, of Montreal, president of the Canada Foundries and Forgings, paid a visit recently to the Welland plants, Canada Forge and Billings & Spencer.

William Bissett Smith, general manager of the Dominion Transport Co., died in Montreal on November 8, in his 87th year. He was born in Huntley, Aberdeenshire, and came to Canada in 1855.

Frank W. Hinsdale, who, after spending a year and a half in helping to organize the work of the Ontario Workmen's Compensation Board, has completed his duties, and has left Toronto for New York.

W. P. Hinton, assistant passenger traffic manager of the G. T. R. and G. T. P., has been appointed traffic manager in charge of passenger and freight of the G. T. P. R., with headquarters at Winnipeg, also Western traffic manager of the Canadian Government Railways.

C .H. Cahan, Jun., of the Canadian Car and Foundry Co., was in Pittsburgh recently with three members of the Imperial Russian Commission. They visited a number of important industrial plants with a view, it was stated, of ascertaining just how soon certain orders they desire to place could be filled.

Refrigeration

Chatham, Ont.—A proposal to establish a municipal dairy is under consideration by the council.

Ottawa, Ont.—The Ottawa Dairy Co. has let the contract for the erection of an ice-making plant to cost $15,000.

Toronto, Ont.—The Board of Control has sanctioned an expenditure of $9,500 for additional cold storage rooms at the Municipal Abattoir.

Rigaud, Que.—Curtis & Harvey have their storage rooms equipped with -ton refrigerating machines, fur- by the Frick Co., Waynesboro,

Wood-Working

George Guentzler will to his woodworking

London, Ont.—The George H. Beton Lumber Co. is planning to add electrical equipment to operate woodworking machinery.

Nelson, N.B.—Fraser, Ltd., Fredericton, N.B., intend to erect a large sawmill at this place. Approximate cost, $100,000.

Rimouski, Que.—Work is about to start on the erection of a shingle mill for Price Brothers & Co., Quebec. Estimated cost, $15,000.

St. John, N.B.—A site has been purchased at Washademoak, N.B., by Daley & Carvell, of this city, on which they will build an axe-handle and woodworking plant.

Marine

A. A. Larocque has been appointed vice-president of the Sincenes-McNaughton Line, Ltd., Montreal, in succession to the late Major A. V. Roy, who met his death recently while fighting with the Canadian forces in France. Mr. Y. Dupre was elected to fill the vacancy on the directorate.

St. Johns, Nfld.—The steamships "Adventure" and "Bellaventure" have been sold to the Russian government and will be used to keep Russian ports clear of ice in the winter. The "Bellaventure" has recently returned from Hudson Bay. Before leaving for Europe a trial trip will be run with Russian officials on board.

Windsor, Ont.—President Pressano of the Great Lakes Engineering Works, announces that he has booked contracts for the construction of four additional steel freighters, three for coast service and one for the Great Lakes trade. The steamer for lakes service will be a ship of about 9,000 tons, of 450 feet keel length, and about 56 feet beam. The three coast freighters will be of Welland Canal size.

Building Notes

Toronto, Ont.—B. C. Whitney and O. B. Sheppard have decided to rebuild the Princess Theatre.

Toronto, Ont.—The New Method Laundry will make an extension to their building to cost about $4,200

Toronto, Ont—The Toronto Hydro-Electric Commission propose erecting a large office building to cost $450,000.

Montreal, Que.—The city of Westmount will erect a municipal building to cost about $150,000. Kenneth G. Rea is the architect.

St. John, N.B.—The Rhodes Curry Co., contractors, engaged on two new warehouses on the dock, have been instructed to build a third. The latter warehouse will be 80 ft. x 350 ft.

Contracts Awarded

Galt, Ont.—The R. McDougall Co. have been awarded a contract by the city for five hydrants at $32.50 each.

Wingham, Ont.—The Canada Furniture Co. has received a large order for shell boxes, and are now making preparations to start work in the Union Factory.

Toronto, Ont.—The Board of Control have let the contract for the supply of stop valves and other apparatus for the main pumping station to Drummond McCall & Company, Toronto, at $8,530.

The Roxton Falls Manufacturing Co. has been incorporated at Ottawa with a capital of $100,000 to manufacture articles in lead, copper, iron, malleable iron and wood at Roxton Falls, Que. Incorporators: Joseph Oscar Fauteux and Joseph Adolphe Desnmarteau, of Montreal.

Chatham, Ont.—The Water Commissioners have awarded contracts for equipment for the pumping station. The contract for the pumps was let to the Canadian Allis-Chalmers Co., and the contract for the motors was given to the Canadian General Electric Co., Toronto. The pumps will have capacities of two million gallons and three million gallons respectively.

Moncton, N.B.—The contract for the steel superstructure of the new bridge over the Petitcodiac River, at this place, has been awarded by the Provincial Government to the Dominion Bridge Company of Montreal. Announcement to that effect has been made by the Provincial Board of Works, and it was said that the contract price would reach about $125,000. The sub-structure will cost approximately $200,000, making the total cost of the bridge about $325,000.

Railways—Bridges

Victoria, B.C.—The C. N. P. R. is to resume construction work on the Vancouver Island sections of the system, not only in respect to the line to Patricia Bay and that to the West Coast, but also in the matter of the de-

From Ironfounding to 4.5 in. Howitzer Shell Production

Staff Article

That the manufacture of high explosive shells can be successfully undertaken by practically any metal working enterprise when backed by an energetic and resourceful staff is here indicated. Particular note may be made of the fact that the entire plant staff of molders, core-makers, helpers, etc., has been transferred to the new industry of shell-making.

THE shell manufacturing plant which we here feature is a development arising from the transformation of part of a general iron-foundry into a machine shop, and serves to further indicate the wide variety of enterprise that has been shown in taking advantage of and meeting the munitions demand. The 4.5 in. howitzer type shell is the particular product, but as the procedure adopted is more or less similar to that practised in plants which we have previously described, a general outline only of the operations is given; the methods and devices original to the establishment are, however, dealt with in more or less detail.

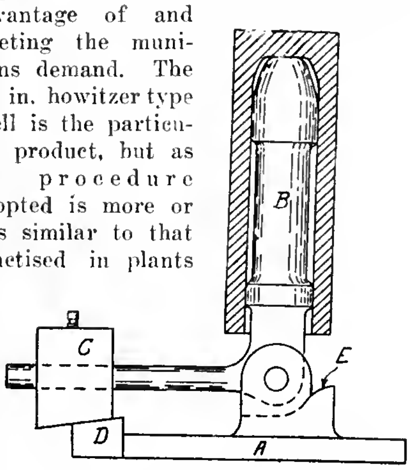


FIG. 1—CENTERING JIG

Cutting-off and Centering

Two "Hall" cutting-off machines are used for cutting the rough shells to length. These machines are placed in a shop separated from the main building. After the forgings have been trimmed to the desired length, they are taken to a drill press and the base centered.

The jig used for this operation is shown in Fig. 1. The base A is secured to the drill table in a position that brings the post B directly in line with the drill spindle. Secured to the handle of the L piece B is the adjustable block C, which acts as a balance weight and also as a gauge, as the lower surface is shaped at an angle and rests upon the beveled edge of the boss D. Alignment of the post B with the centering drill can thus be attained by adjustment of the block C. The stop E allows the post B to remain at an angle while the shells are being put in place or being removed.

Rough Turning

Rough turning is performed on three 26-inch Boye & Emmes lathes. The shells are placed between a short tapered rose arbor, which fits into the open end and the tail centre, being forced on firmly by the pressure from the tail stock spindle.

Boring

The boring operation shown in Fig. 2 is done on three 26-inch Boye & Emmes engine lathes. A special feature of this operation is the absence of turret or tool vibration. This firm, when entering the shell business, had great difficulty in obtaining the necessary machinery on reasonable delivery, and were forced to install machinery of somewhat larger range than necessary. However, this apparent objection has proved to be more of an advantage than otherwise, as greater rigidity and increased output have been the result.

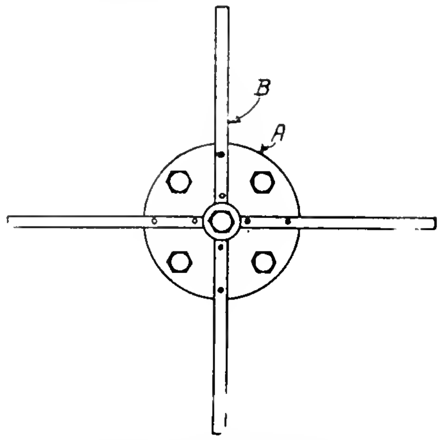


FIG. 3—SHOWING INCREASED LEVERAGE FOR HAND WHEEL

As shown in Fig. 2, special four-sided turrets are used. In the designing and the construction of these, the superintendent of the shell shop (formerly superintendent of the iron foundry) gave particular attention to the strength and stability of the device. The boring bars and cutting tools are so designed and arranged that little or no movement is observed when in operation. A small hole is drilled through the bars from the front end near the cutting tool to a location just in front of the turret face. A small piece of tubing is inserted in a hole drilled to meet the first hole, and the cutting compound is forced through this hole to the bore of the shell from the rubber tube shown.

Another noticeable feature on this operation is the absence of the customary steady head supporting the shell chuck. The increased diameter of lathe spindle and added strength renders the steady rest unnecessary. The output on these machines is, on an average, 62 shells each ten hours. An arrangement similar to Fig. 3 is secured to the traverse hand wheel on the apron to ob-

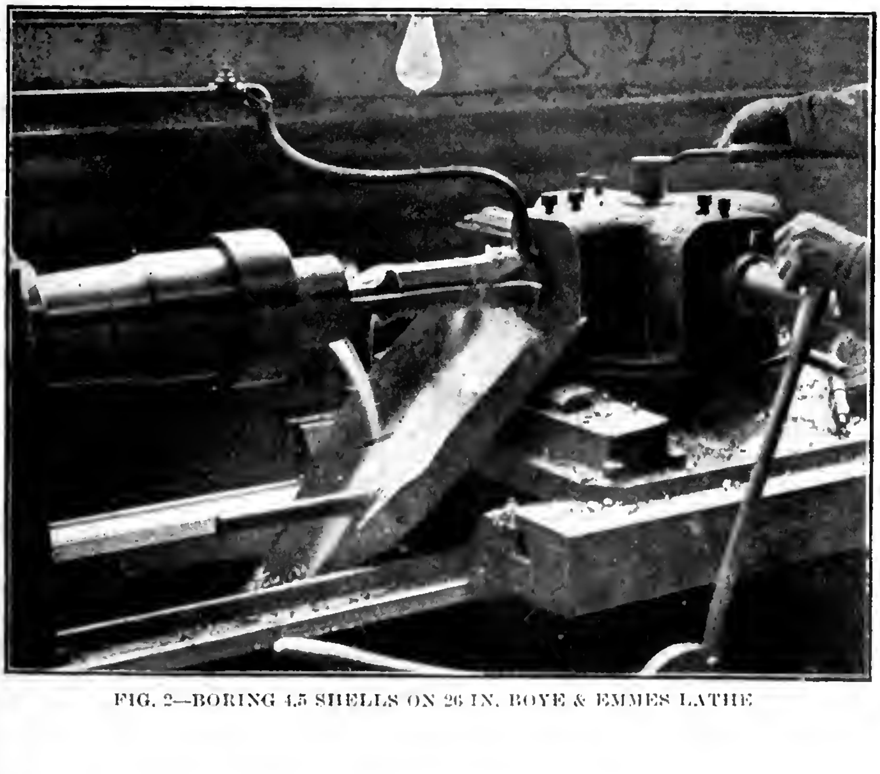


FIG. 2—BORING 4.5 SHELLS ON 26 IN. BOYE & EMMES LATHE

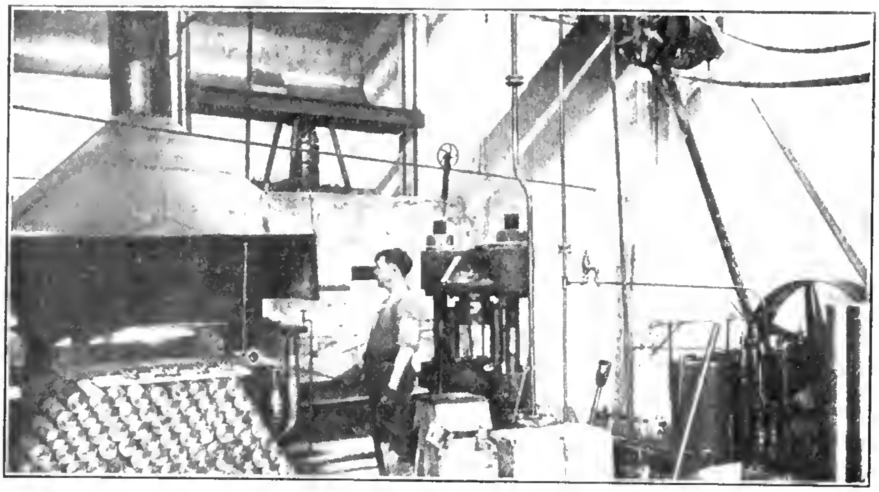


FIG. 4—NOSING EQUIPMENT FOR 4.5 IN. SHELLS

tain greater leverage to force the tool when forming the base contour.

Nosing the Shells

The nosing of the shells, which follows the boring operation, is carried out in the usual manner. The shells are placed in the Mechanical Engineering Co. furnace, shown to the left in Fig. 4. They are heated to a temperature of about 1,550 degrees F., and placed in the 150-ton Boomer & Boschert hydraulic press, which is supplied by power from the three-cylinder hydraulic pump, shown to the right of Fig. 4. The pump was built by the Canadian Boomer & Boschert Press Co., of Montreal. The nosing die is made of tool steel and encased by a water jacket. After nosing, the shells are placed in powdered lime to anneal for further machining. The furnace is also used to anneal the base discs when these through any cause are difficult to machine.

Boring and Threading Nose

Two 26-inch Boye & Emmes engine lathes are used for boring the shell nose. Special turrets have been made by the St. Lawrence Iron Foundry, Montreal, and placed on the saddle of these machines. The shell is held in a chuck similar to those described in previous articles, and the cycle of operations is boring, inside profile, face and chamfer end, recess and tap. Tapping is performed with a "Murchey" collapsing tap.

Finish Turn and Profile

The diameter and profile are finished on two Boye & Emmes 26-inch engine lathes, the operation being shown in Fig. 5. An auxiliary saddle and compound rest is placed on the lathe saddle, and two tools are employed in removing the metal, one operating on the parallel portion and the other on the profile by means of a cam and weight.

A plan of the arrangement is shown in Fig. 6. The tool E held in the tool-

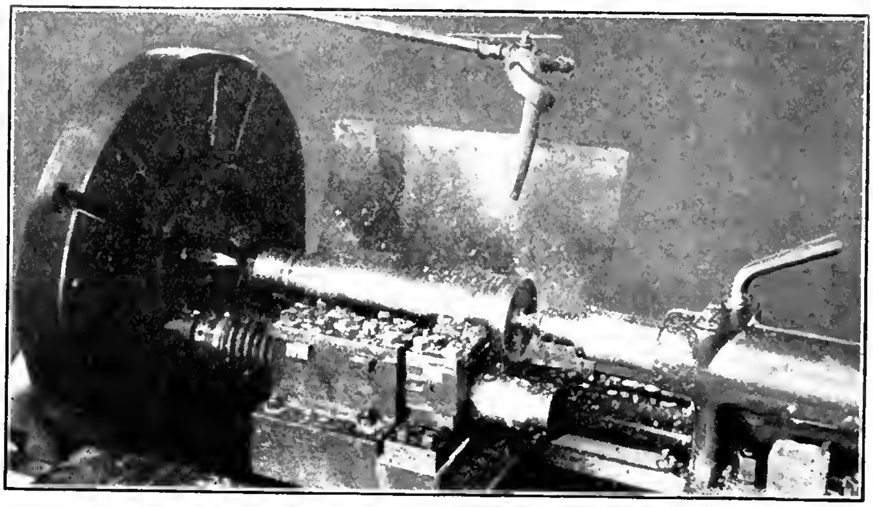


FIG. 7—GROOVING AND WAVING ON 22 IN. "McDOUGALL" LATHE

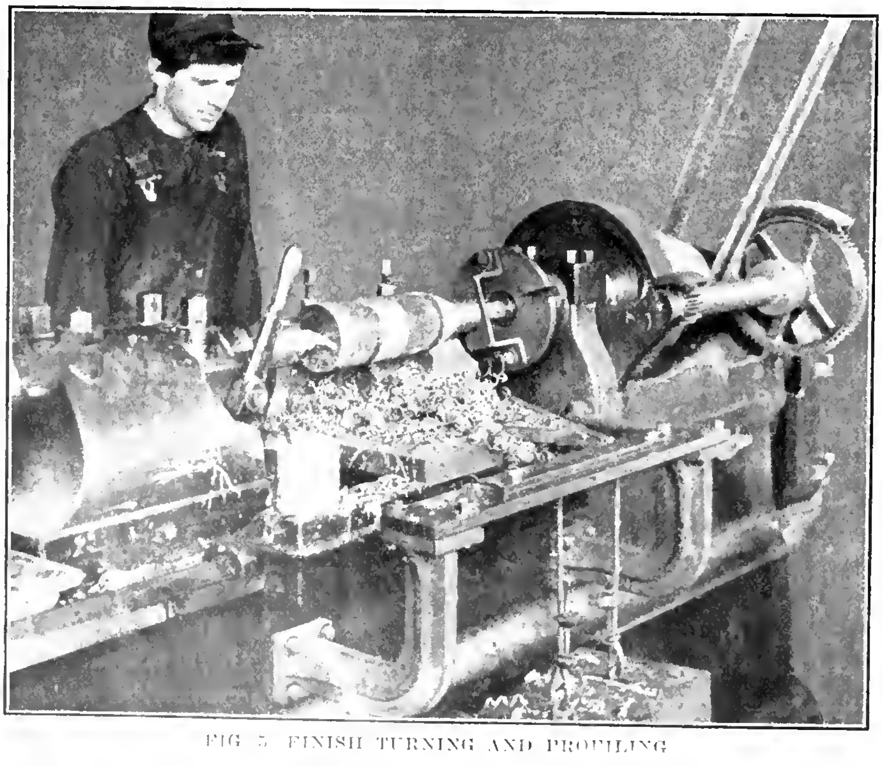


FIG. 5. FINISH TURNING AND PROFILING

post on the compound rest D, is used on the profile of the shell. Secured to the cross slide is the bracket F which carries the hardened steel piece G and is kept in contact with the cam H by means of the weight L supported by cables passing over rollers shown, and secured to studs in the side of the bracket F.

Adjustment of tool E is obtained by the movement in or out of the compound rest D. The cam H is bolted to the bar I, which is secured to the brackets J. These brackets are bolted to the lathe bed below the run of the lathe saddle. Added stability is given to the cam by the brace K, which is bolted to the bracket J at one end and the head-stock at the other.

In order that a correct profile may be produced, the cutting point of the tool E should be in line with the contact point of the piece G when a line drawn from point to point is at right angle to the axis of the shell, or lathe spindle.

The auxiliary saddle A supports the

compound rest B which carries the tool C for turning the parallel section of the shell. With this arrangement the actual traverse of the saddle necessary to complete the outside is a little over one-half the length of shell.

Obtaining the Weight

After the shells have been finish-turned, they are weighed, and the base faced off to obtain the desired weight. To calculate the required amount to face off, divide number of ounces by 72; which is the approximate weight in ounces of one inch in length of 4.5 inches in diameter.

Groove and Wave

After the base has been faced off, the shell is taken to two 22-inch R. McDougall engine lathes, where the grooving and waving is performed. This operation is shown in Fig. 7. The various operations are all completed from the front of the shell by moving the saddle to the desired position. The device here shown was designed and constructed by the St. Lawrence Iron Foundry Co., Montreal, and is showing excellent results. An average production of 100 shells is obtained on each machine every ten hours.

A sketch of the arrangement is shown in Fig. 8. The base A of the device is secured to the cross slide, and is stationary in relation to the cross slide. This piece carries the two tools C and D. The sliding piece B carries the waving tool E.

Secured in the sliding block B and passing through the piece A is the shaft F, which carries in the forked end the roller G. This roller rides on the surface of the cam H, which is bolted to the face plate of the lathe. The desired tension is obtained by the lock nuts and spring shown. The successive operating tools are set a sufficient distance in advance, so that each tool will clear the shell while the next one is working.

Shell Support

A very handy and serviceable attachment used on this and other operations is shown in Fig. 9. The piece A is secured to one of the braces B in the bed of the lathe, and supports the shell C at the required height, thus relieving to a large extent the labor otherwise necessary in handling. The full lines show an end view, and the dotted lines a side view of the support.

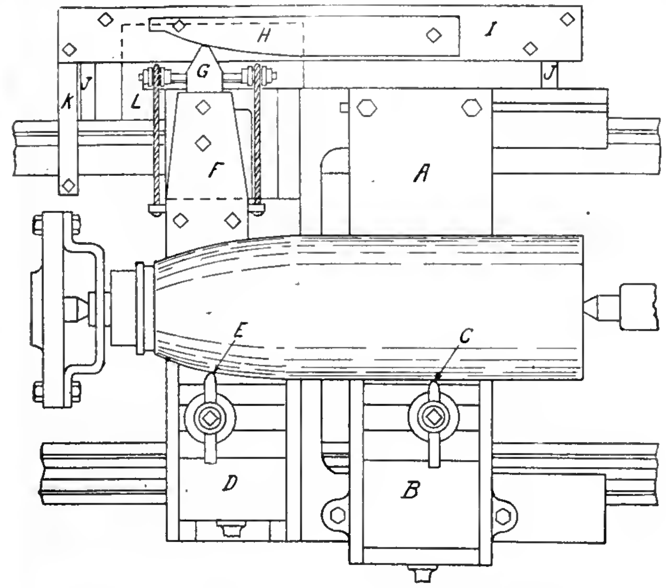


FIG. 6—PROFILE AND OUTSIDE DIAMETER FINISHING

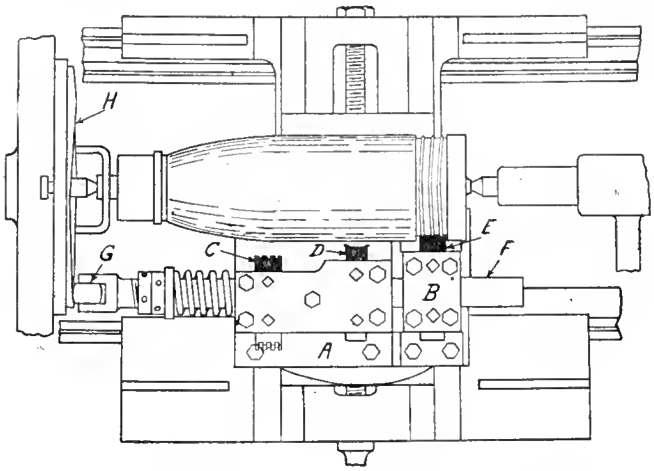


FIG. 8—GROOVING, UNDERCUTTING AND WAVING

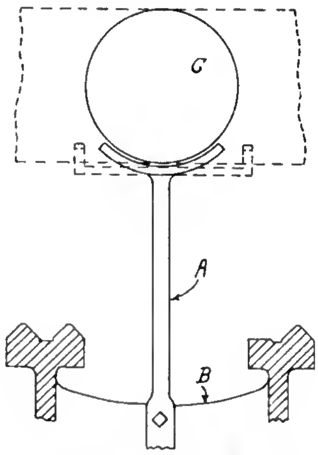


FIG. 9—SHELL SUPPORT

Base Plate Recess

The base and recess for base plate are finished in Boye & Emmes and R. McDougall 20-inch engine lathes fitted with special turrets built by the St. Lawrence Iron Foundry Co., Montreal. The base plates, instead of being threaded, are riveted in, as shown in Fig. 10. They are finished from the rough forging on an R. McDougall 20-in. lathe.

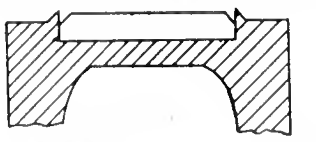


FIG. 10—ARRANGEMENT FOR RIVETING IN BASE PLUGS

The brass sockets are next screwed in and turned on 18-in. Boye & Emmes engine lathes, after which the small hole for the grub screw is drilled through the brass socket and tapped.

The copper bands are pressed on in a "Fairbanks-Morse" banding press and turned in a "Jenckes" band turning lathe.

The shells are next taken to the sandblasting room, where the bore is entirely cleaned from grease and other foreign matter in readiness for varnishing. After the varnish has been run in and out, and thoroughly drained, the shells are baked in an oven for some four or five hours.

Painting and Crating

After the baking process, the shells are taken to the painting department to receive the final touches before crating and shipping.

High Explosives.—There has been a good deal of talk in the papers lately about high explosive shells. These are of two kinds—the one with thick walls, which is almost as effective as shrapnel for man-killing under all conditions, and the thin-wall, or torpedo shell, chiefly useful for the work of destroying fortifications. These latter are dangerous to handle, as they contain a quantity of high explosive, and if they burst while being fired ruin the gun and everything around it. They are lighter than shrapnel, and, therefore, require the use of different range tables. Any reluctance of the authorities to adopt a new form of thin-walled explosive shell in the middle of a big war can be well understood. The explosive used is generally picric acid or T.N.T.

Large Shells: Production Problems and Possibilities--II.

By C. T. D.

In preparing to undertake the production of large shells up to 9.2 in. dia., manufacturers will encounter problems of a nature altogether different from those connected with 18 pdr. shells. Automatic machinery will not be so applicable to the larger sizes, and productive ability will centre largely on such points as sequence of operations, tooling methods, etc.

NEXT to having the total weight of a projectile within the specified limits, the most important requirement is that which limits the amount of eccentricity between the outer and inner surfaces. In other words, while the thickness of the walls may vary within generous limits provided the total weight is correct, it must not be assumed that these limits can be applied indiscriminately to various portions of a particular shell.

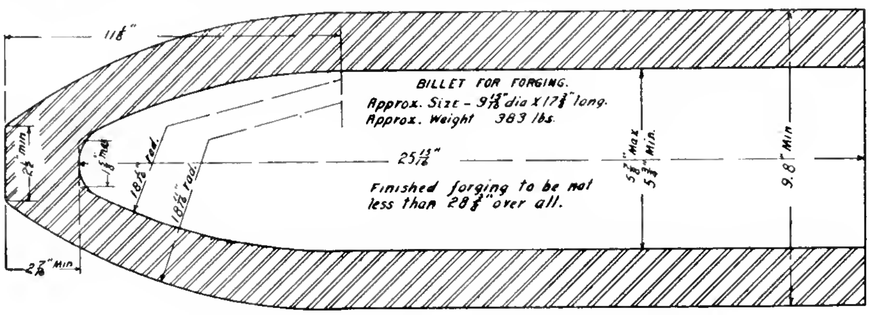


FIG. 1. FORGING SIZES FOR 9.2 IN. HOWITZER SHELL.

Such a shell might easily be out of balance to a degree which in addition to causing excessive wear on the lining of the gun, would cause its behaviour during flight to be dangerously erratic, to say nothing of nullifying its effect on enemy works. The necessity of strict limitation of this error will, therefore, be evident, and manufacturers who use every possible means to produce shells perfectly machined in this respect earn a commendation which does not materialize, but is none the less merited.

Similarity of Large Shells

The 8-in. and 9.2-in. shells differ principally in size. The methods of machining the larger shell apply equally to the smaller and the operations as outlined below are arranged with the view of using machine tools of standard types such as are already installed in plants handling products of moderate weight and dimensions. The approximate sizes of the 9.2-in. rough forging are shown in Fig. 1, the finished sizes being shown on the drawing published in the previous issue of this paper.

The number of operations included in any one group are the maximum which it is advisable to include. Where machines and men are available, operation groups may be split up, but whereas in the case of shrapnel, etc., it was possible to subdivide and simplify operations to a very large extent, thus permitting the use of unskilled labor, the mechanical skill and ability required to insure profitable and rapid production of these large shells, can be utilized to greater advantage by performing as much work at one setting as the machine is capable of. This reduces to a great extent the number of individual workers through whose hands any one shell must pass, and correspondingly reduces the possibility of loss through carelessness or lack of skill.

Factors in Production

Efficient production, therefore, is not so much a question of having a large number of different kinds of machines doing single simple operations with unskilled labor, as of having sufficient machines of fewer types, and concentrating on tool outfits which will enable skilled help to reach and maintain a large output of work which could not be handled by unskilled labor without constant risk of loss due to bad work, or breakage of machines through inattention.

The operations as outlined below are arranged in a number of groups, each of which can be handled conveniently on standard types of machines with such special tooling as individual makers may develop. Special purpose machines for one or more operations will be described in due course; at present all suggestions and descriptions refer to such methods as can be adopted with existing machines.

OPERATION TABLE.

Operation Number	Description.
	Group A.
1	Grind off scale on point, forming small flat.
2	Place on expanding arbor which locates shell from inside, and positions it lengthwise from inside of nose.
3	Face-off nose of shell to necessary thickness.
4	Drill centre with drill in tail stock, remove drill and adjust dead centre.
5	Rough turn body, commencing at nose and traveling to point where open end of shell is cut off.
6	Cut off open end of shell to length measured from nose.
	Group B.
1	Drill hole in nose, leaving stock for final boring.
2	Chuck by nose with outer end in steady. Nose of shell in contact with gauge stop on chuck.
3	Bore parallel portion with roughing and finishing cutters.
4	Form interior of nose or arch.
5	Finish overall length and counterbore. Tap base.
	Group C.
1	Tap nose.
2	Insert threaded driving plug centre in base, and common threaded plug centre in nose.
3	Finish outside to size and shape.
4	Machine and undercut groove. Wave ribs.
	Group D.
1	Press on driving band.
2	Machine driving band.
	Group E.
1	Remove service plugs and assemble base plug and nose bushing.
2	Face off base and finish bushing.
3	Enamel interior and bake.

Regarding the Operations

(Group A.) Removal of scale on the point of the forging by grinding is advisable where a rough grinding wheel is available and it should be used in preference to machining. There is no reason, however, why the point should not be cleaned off as part of operation A3, if suitable provision is made for the tool. Fig. 2 illustrates the operations referred to in group A, from which it will be seen that the use of a square tool box would allow of another tool being set up for the purpose of cleaning the nose, but the distressing effects of the scale on the cutting edge will be avoided where grinding is possible.

Trimming the open end is listed as

operation A 6. This operation is sometimes performed first or second, and where the number of machines is such that a lathe or cutting off machine can be operated continuously on this work, it may be done then instead of later, but the fact should not be overlooked that the time spent in chucking and removing from the cutting-off machine is a straight addition to the total time on the shell. By performing operation A 6 on the same machine as the other A opera-

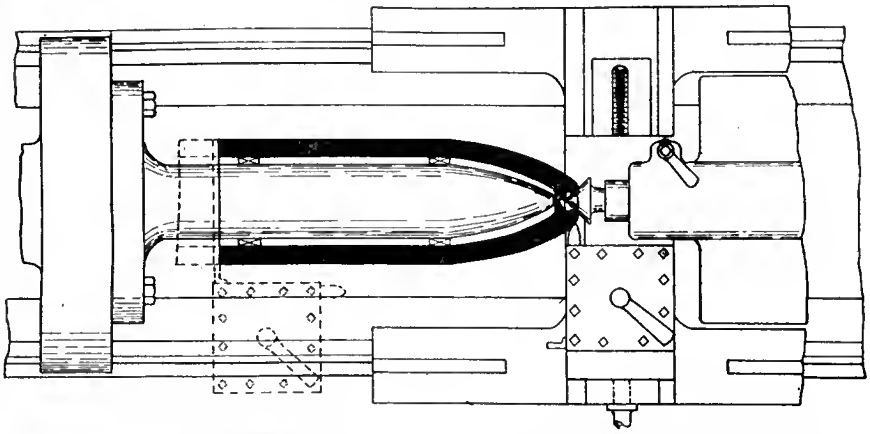


FIG. 2. ROUGH TURNING AND CUTTING OFF ON REGULAR ENGINE LATHE.

tions, the time of this extra handling is saved.

Proceeding now to A 2, a lathe of ample power is necessary, as the roughing must be done in one cut if satisfactory progress is to be made. All of the power and stiffness available in a 30-in. lathe with 6-in. belt is none too much for the continuous strain of pulling a heavy cut on projectile steel.

The design of expanding arbor should

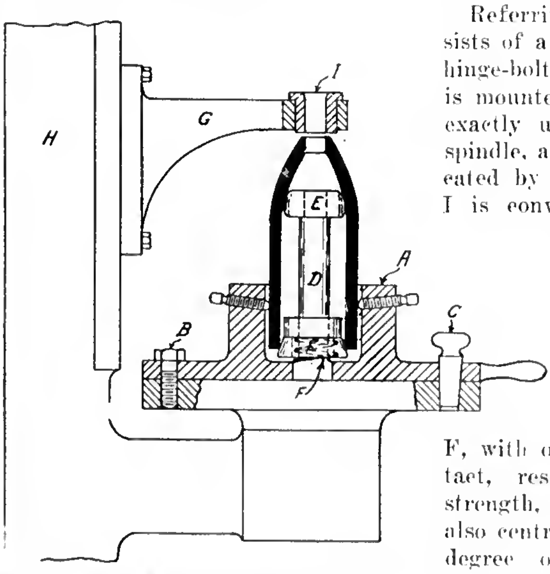


FIG. 3. FIXTURE FOR CENTERING AND DRILLING SHELL FORGINGS IN DRILL PRESS

be such that all possible strength is obtained at the root of the stem where it spreads out into the driving flange. Numerous types of expanding mechanism have been devised for arbors handling the smaller sizes of shells and modifications of these can be adopted if ample power be provided for expanding the driving dogs.

The nose of the shell is now faced off to a specified distance after which the centre is drilled in the conventional manner, and the dead centre adjusted, when the operation of rough-turning the outside may be proceeded with.

An alternative method of procedure up to this point, and one which will appeal to the small producer, is to centre the shell in a drill press and then chuck it by the untrimmed base in an ordinary four-jaw independent chuck, supporting the outer end in the tail-stock. After rough turning, the shell would be cut off close to the chuck. A suitable centering fixture is shown in Fig. 3. If preferred, the nose may be drilled out to approximate size and a pipe centre used afterward in the lathe.

Referring to Fig. 3, the fixture consists of a plate A, which swings around hinge-bolt B. A vertical stem or arbor B is mounted on the plate so as to pass exactly under the centre of the drill spindle, and when in this position is located by taper pin C. A drill bushing I is conveniently supported from the column of the machine. The upper end of the arbor is provided with a three-cornered flange E, which centres the forging from the inside, while a similar method is adopted at the lower end where a tapered plug, F, with or without three-point contact, rests on a spring of suitable strength, so that the base of the shell is also centred from the inside with a fair degree of accuracy. Set-screws, as shown, hold the shell firmly while being drilled.

The shell is now transferred to the engine lathe where an arbor of similar type is employed. The point of the arbor projects right up to the end of the nose where it has three-point contact on a circle slightly larger than the hole. The back end of the arbor has a spring controlled taper plug for centering from the inside. With the tailstock centre pressing the forging against the point of the arbor, and the open end centred by the spring plug, the chuck jaws are tightened up carefully around the base, when operations proceed as before. When this method of driving is adopted, it may be found preferable to face the nose down to thickness by means of a short cutter-bar used in the tail-stock and having a pilot to neutralize the long overhang of the shell from the chuck.

Assuming that up to this point a satisfactory sequence of operations has been decided on, the shell is now ready for rough turning.

Chief interest in this operation centres around the method of forming the profile. The radius link method is simple to construct and operate, but calls for close duplication in placing the forgings, and considerable accuracy in locating the point at which it is disengaged and a parallel cut started. A plan view, Fig. 4, shows the principal features of this method.

Secured to the cross-slide A is the stud B. Upon this stud is placed one end of the link C, the opposite end of which is placed over the stud E, which is held in the bracket D. This bracket is firmly bolted to the bed of the lathe, the stud E protruding above the level of the saddle.

The tool rest, and cross-slide as well as the stud B will travel as a unit; therefore the path of the cutting point of the tool will be an arc of a circle, whose radius will equal the length of the link C. Care should be taken to have the

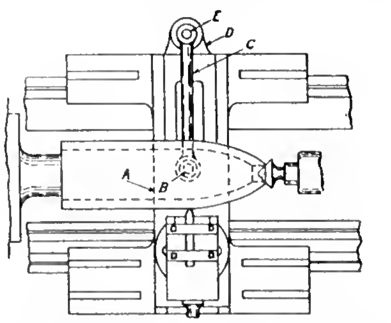


FIG. 4. METHOD OF USING LINK FOR FORMING PROFILE ON SHELL.

cutting tool in the proper position when the link C is at right angle to the axis of the shell or lathe spindle.

The length of the link, between centres, for the 8-in. shells would be 15.9 inches, and for the 9.2-in. shell would be 18.4 inches. The desired size is obtained by the use of the compound rest. It might be well to state that no matter in what position the tool is, the radius of the contour will always be the same when the same link is used.

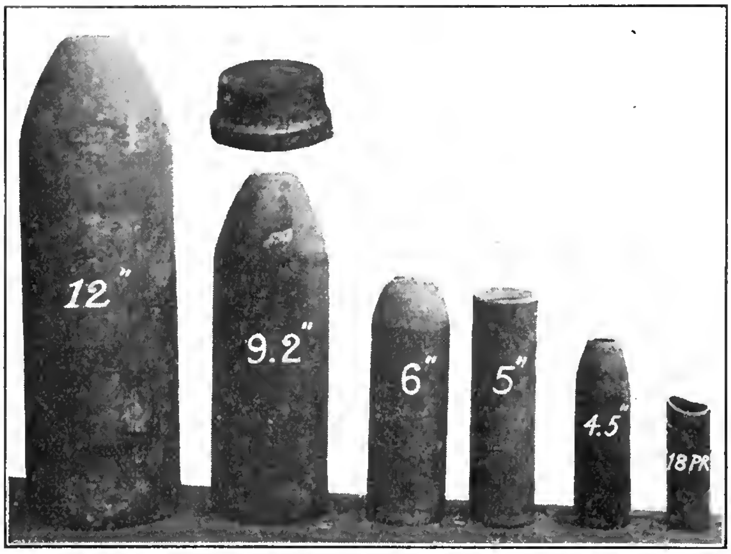
The method of forming the profile

from a copy bar either at back or front of the carriage has attained a fair degree of popularity and will doubtless be adopted by several makers. Once it is adjusted for position, it requires little attention to operate.

The necessity for accuracy in machining the thickness of the nose now becomes apparent. While the outside diameter of the parallel body can be easily measured by gauges, and the approximate thickness of wall readily determined, the same method cannot be used on the nose profile. Assuming, therefore, that the nose has been faced so as to leave a safe thickness of metal, the extent to which the outside can be machined can be determined from the reduced diameter of the flat end of the nose.

If, when the parallel portion is roughed to size, the diameter of the point of the nose is still large, the cutting tool must be moved to the left, but not any nearer the centre. The effect of this is to take another cut from the outside of the nose, but no more from the diameter of the body. The actual dimensions of nose thickness and diameter of the face when rough turned require, therefore, to be carefully determined at the start, after which suitable profile gauges will enable rapid production to be maintained.

The rough cut is carried down to the base till enough machined surface is obtained. Should the base have been cut off in the first place, no further work will be required under group A, but if not, the point for cutting off the base can be accurately located from the point of the nose, after which the shell is ready to proceed to the operations outlined in group B.



GROUP OF SHELL FORGINGS.

LITTLE KNOWN FACTS ABOUT GRINDING—BELTING

By H. W. Dunbar.

HOW many operators or owners of grinding machines fully realize the important part the belting plays in the actual production and quality of the work accomplished in a grinding machine? I think very few. This statement is based on observations made while passing through shops using a great many grinding machines.

The Finish Feature

To begin with, when one desires to finish work having a true, high-reflecting surface, free from chatters and mottles, the belts must be absolutely true when running, and must have a uniform thickness throughout their entire length. The slightest variation in thickness either where an endless belt is joined together or where a lacing of wire, rawhide or other material is used, will immediately set up a vibration in the parts with which this belt is connected. These vibrations, if of great enough magnitude, will be transmitted to the wheel or the work, and the result will be chatters or mottles. This applies, of course, primarily to those belts in close proximity with the wheel and work, such as the belt running from the motor to the frame drum on the back of the slide, or from the drum to the wheel spindle, or from the headstock (if it be a belt driven machine) to the drum overhead. When one desires a finish of such a degree of perfection, the belts must be as smooth in their running as it is possible or practicable to make them.

The trouble generally comes when the original belts, which have not only to be true for thickness but run true as well, have been worn out and have to be replaced. It is then that great care must be taken to see that a good quality belt, perfectly true, be selected to replace the old one. To maintain this condition indefinitely throughout the life of the belt it becomes necessary to select the very best grade and quality of belting for a grinding machine. Never replace an endless belt with one carrying a wire lacing or any other form of lacing which will give a "bump" as it passes over the pulley: if you do you cannot get smooth work. So much for finishing.

The Production Feature

On the question of production, it is well known to the designers of grinding machines that uniform speed of the wheel and uniform revolution of the work are essential to the greatest efficiency of the machine. If for any reason the wheel slows up while performing work, the cutting action immediately changes and production falls off; the same is true of the work if it varies in speed. The relative speed of the wheel to the work, when the correct speed has once been selected, must be maintained constant. This affects not only the production of the parts being ground, but also the wheel wear.

From this it will be seen that it is necessary that the belts be of the proper width to transmit the power necessary to do the work. They must also be maintained at a constant, uniform tension, which will also insure a constant speed.

Care must be taken to prevent oil and grease from getting on the belts to aid in maintaining this condition. Do not fill the spindle boxes so full of oil that they run over and drop on to the belts. Learn how much oil must be put into each place, and keep the oil level, so adjusted as not to waste the oil and bring about unsatisfactory results through its being distributed over the belts. It will be seen that poor belting will stretch in spots and not allow the belt to have a uniform friction on the surface of the driving pulley, resulting in loss of speed.

As a last word of caution, keep the belts smooth; keep them true; and always replace the original belts with others of the same grade, quality, thickness and width. Keep them free from oil and foreign substances.—Grits and Grinds.

MAIL TO SOLDIERS

IN order to facilitate the handling of mail at the front and to insure prompt delivery it is requested that all mail be addressed as follows:—

(a) Regimental number.

(b) Rank.

(c) Name.

(d) Squadron, Battery, or Company.

(e) Battalion, Regiment (or other unit), Staff appointment or department.

(f) Canadian contingent.

(g) British Expeditionary Force.

(h) Army Post Office, London, Eng.

Unnecessary mention of higher formations, such as brigades and divisions, causes delay.

Sheet Metal Elbows: Their Development and Laying Off-IV

By J. W. Ross

In order to thoroughly understand the principles involved in the development of cylindrical and other forms, such as are met in sheet metal work, a considerable knowledge of geometry is desirable. Through the medium of these articles, the author places practical examples at the disposal of our readers, and the knowledge to be gained by a close and persistent study of the principles and methods employed will well repay the time spent.

180-DEGREE ELBOW

FIG. 18 shows the elevation and cross-section of a 7-piece U-shaped elbow of 180 degrees plated with inner and outer courses.

Mark off the inside diameter, CD, $23\frac{1}{2}$ inches, and the outside $24\frac{1}{2}$ inches, thus making the neutral diameter 24 inches. Measure off D to O equal to 21 inches. With O as centre and the inside diameter at C as radius, strike the arc CC^1. Again with O as centre and the inside diameter at D as radius strike the semicircle DD^1. Divide the semicircle CC^1 into 12 equal parts. As the elbow is made up of seven courses, each part will then be equal to 180 degrees $\div$ 12 equal to 15 degrees. At the points located draw in the radial lines as AO, LO, NO, PO, JO, KO. Draw in plate thickness from C and D to the mitre line AB, and at right angles to the line CDO. Draw in the thicknesses LN and L^1N^1 of the course J with the inside diameter tangent to the two semicircles CC^1, DD^1, respectively. This may also be done by using O as centre and the thicknesses A and B as radii (course R), marking these distances off on the radial lines from O as centre, and locating the thicknesses at LNPJK, also $L^1N^1P^1GM$. Connect these points by lines representing the plate thickness for the inner courses, also draw in the outer courses as shown in Fig. 18.

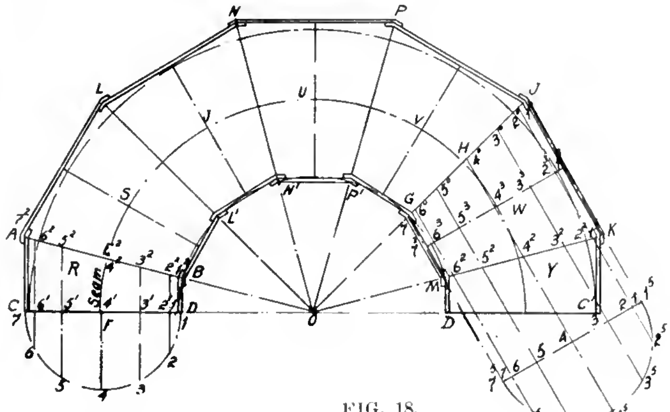


FIG. 18.

With centre 4^1 and the neutral point 7 as radius, draw in the half section plan view 741. Divide this into a number of equal parts. From these points draw in the construction lines—through and at right angles to CD—to the mitre line AB. Number as specified.

Calculate the stretchout of the neutral diameter 7 1, which is 24 × 3.14 equals 75.36, or nearly $75\frac{3}{8}$ inches. Measure off this distance along the line FCDF, Fig. 19. Divide this into twice the number of equal parts as in 7 4 1, Fig. 18. Raise perpendiculars from these points and number accordingly. Transfer all the distances from course R in a similar manner as explained in previous problems. Fig. 19 shows the whole pattern for R and Y courses, and the half pattern for courses J and V.

The courses S, U, and W are outside courses and require to be developed as such. For sake of clearness the centre girth line 7^31^3 of course W is projected to 7^51^5. Centre line HL is extended to 4 4^5; with 4 as centre and the neutral radius of course W, which is 4^57^5, draw in the neutral half-section plan view of course W, as $7^54^51^5$. Divide this semi-circle into an equal number of parts. From these points draw lines parallel to JK and $HI4^5$, to their intersections on JHG. Number these lines as shown, and then calculate the stretchout. The inner course is $75\frac{3}{8}$ ins.; an easy fit is desired for the outer course, therefore to this measurement add on $6\frac{1}{2}$ times the plate thickness. The stretchout for the outer course will equal $75\frac{3}{8} + (6\frac{1}{2} \times \frac{1}{2}) = 78\frac{5}{8}$ inches. Measure this distance off along the line $4^34^34^3$, Fig. 20. Divide into twice the number of equal parts as are used in the half section view 7 4 1, Fig. 18. Draw perpendiculars through these points. Number as shown, so that the longitudinal seam will be located at HL, Fig. 18, when the course is rolled up.

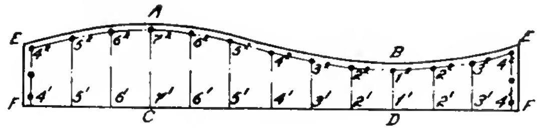


FIG. 19.

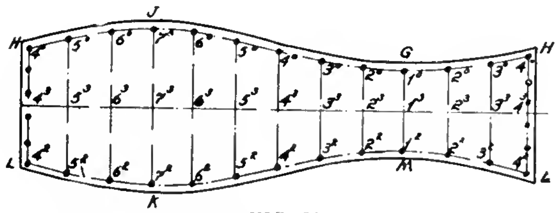


FIG. 20.

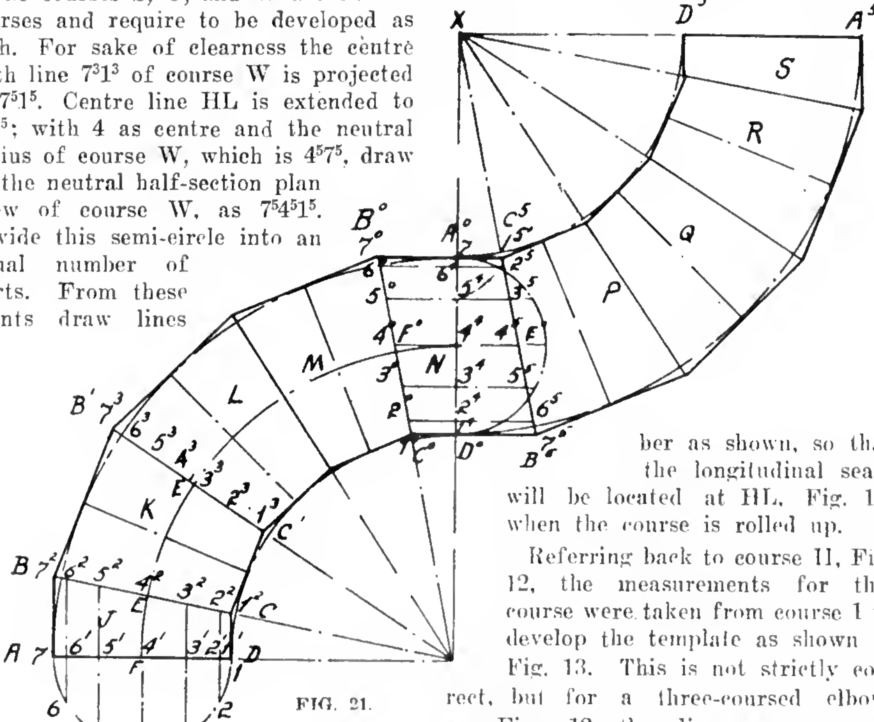


FIG. 21.

Referring back to course II, Fig. 12, the measurements for this course were taken from course 1 to develop the template as shown in Fig. 13. This is not strictly correct, but for a three-coursed elbow, as Fig. 12, the discrepancy would be immaterial, as this only comes in the one course. In an elbow of several courses this difference would be propor-

tionate to the number of courses and the thickness of plate used.

It will be noticed in Fig. 12 that the distance BC is slightly longer than AB and that JH is shorter than JK. This appreciable difference coming in each of the three courses, S, V, W, would not be conducive to accuracy. With this defect pointed out, the template, Fig. 20, will be developed from the construction lines on course W, Fig. 18, which are drawn in for this purpose.

With dividers set to the distances $7^3 7^0 6^3 6^0$, etc., Fig. 18, transfer over to $7^3 7^0$, $7^3 7^2$, $6^3 6^0$, $6^3 6^2$, Fig. 20, similar to the preceding problems. Fig. 20 shows

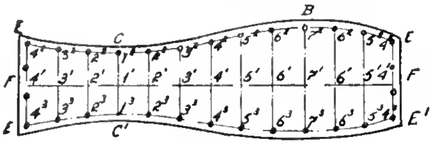


FIG. 22.

the complete template with lags added and rivet holes marked in. It is again repeated that it is not necessary to draw in the full elevation view as shown in Fig. 18, unless desired. All the necessary information can be obtained by calculating the mitre line and on this drawing in the construction lines as shown by course R, and the construction lines of course W, drawn on course S. Therefore all that need be drawn will be courses R and S.

Double Elbow

Fig. 21 shows a double elbow of 9 courses. It is drawn out in full elevation to illustrate the method of obtaining the development of course N.

Measure off AD 18 inches, and OD 22 inches. With centre O and radii OA and OD strike the quadrants AA^0 and DD^0. Draw A^0D^0O at right angles to ADO. With radius OA, mark off the point X on the extended line OD^0A^0X, from the point D^0. With the same radius and X as centre, draw the quadrant D^0A^5; also

FIG. 23.

with X as centre and XA^0 as radius draw in the quadrant A^0D^5. XD^5A^5 is parallel to ADO and at right angles to XA^0D^0O. Divide the quadrants AA^0, D^0A^5 each into 8 equal parts and connect these points to their respective radial points O and X. Draw in the outline of the pipe similar to preceding problems. Fig. 22 shows the whole templet for courses KLMPQR, and half of this templet will be the pattern for courses J and S.

Course N will now be developed. On neutral diameter A^0D^0 strike the half-section view $A^0E^5D^0$. Divide this into the same number of parts as course J. Draw construction lines from these points parallel to B^0C^5 and C^0B^5. Number as shown. The stretchout of the diameter A^0D^0 is equal to the stretchout of the diameter AD, course J, which is 18×3.14 equals $56\frac{1}{2}$ inches. Measure off A^04^4,D^0, Fig. 23, equal to $56\frac{1}{2}$ inches and divide this line into 12 equal spaces, which is twice the number in the half sectional view $A^0E^5D^0$, Fig. 21. Draw perpendiculars through these points. With the longitudinal seam on 4^04^5, Fig. 21, number accordingly on Fig. 23. With dividers set to 4^44^0, Fig. 21, transfer over to Fig. 23 as 4^44^0; reset the dividers to 4^44^5, Fig. 21, and transfer over to 4^44^5. Fig. 23. Similarly transfer all the rest of the measurements over to Fig. 23. The complete templet is shown in Fig. 23 with rivet line in rivet centres and lap allowances drawn in.

SAFETY IN CRANE CHAINS

By E. B. Morgan

AFTER quite an extended study of failures due to a crystallized link, the writer has concluded that they are due to imposed stresses equal to and in excess of the elastic limit, and in this brief discussion will attempt to show that the crystallized link is undoubtedly due to overloading and cannot be prevented by annealing.

The term crystallization is undoubtedly a misnomer, as all steel and iron is originally crystalline in structure. What really takes place is that the working of the metal beyond the elastic limit simply breaks down the long fibers or granulates them. It is simply a condition of fatigue. The characteristic hardening or brittleness of the metal in this condition is undoubtedly due to the heat which is set up internally by the slippage of the fibers.

Determing the Safe Load

The writer is firmly convinced that the proper safe load should be based upon a permissible working stress for the extreme fiber, and not on the ultimate breaking strength test of the chain. This necessitates the solution of the maximum extreme fiber stress developed in an elliptical shape which is the usual shape of a chain link, and involves a theory which has received very meager attention in technical works. There seems to have been only one attempt to develop a formula for the fiber stress developed in an elliptical ring based on experiment and good sound theory. I refer to a thesis on the strength of chain links made at University of Illinois Experimental Station in 1907, in which the following formula has been developed for open links. This formula can be readily derived by applying the theory of flexure in curved shapes.

$$f = \frac{P}{0.4d^2}$$

Where f = extreme fiber stress in tension.

d = diameter of the stock used in link.

P = load on the chain.

In a recent bulletin on safe loads issued by the National Safety Council, the subjoined safe loads for straight suspension for wrought iron hand-made short link chain are recommended. The writer has found by actual experimental tests that these values are on an average of about one-seventh of the ultimate breaking strength, and are in fact a trifle lower than the loads imposed in general practice in most plants.

Size	Safe load
½ in	2,400 lb.
⅝ in	4,000 lb.
¾ in.	5,500 lb.
⅞ in.	7,500 lb.
1 in.	9,500 lb.

With these recommended safe loads the following stresses in the extreme fiber are developed by using the formula as cited above.

½ in.	24,000 lb. per sq. in.
⅝ in.	25,600 lb. per sq. in.
¾ in.	24,500 lb. per sq. in.
⅞ in.	25,000 lb. per sq. in.
1 in.	23,700 lb. per sq. in.

This means that the extreme fiber will be stressed up to and in excess of the elastic limit in the case of an iron chain, as the writer has made repeated tensile tests on Norway or Swedish iron, which is about as pure as any commercial iron obtainable, and has never developed more than an average ultimate tensile strength of 44,000 lb. per square inch, and an average elastic limit (or drop of the beam) of 23,500 lb. per square inch.

This shows how such loading as exhibited produces stresses in excess of the elastic limit, notwithstanding the fact that the impact stresses due to mechanical braking when lowering the hoisted load, which are no doubt very severe under certain conditions, have been neglected. It is evident this magnifies the danger in applying stresses which will destroy the resiliency of the metal. This is, without a doubt, the reason why chain links become brittle and fail. It is also the reason why the average user encountering such difficulties resorts to annealing as a remedy.

The Annealing Question

There has been much said of late both pro and con concerning the annealing of chains for restoring the metal from the so-called crystallized condition to the original physical properties. No doubt this annealing is a good thing in that it often forestalls failure, not because the

metal has been completely restored to its original qualities, but because it has simply been made tougher. The writer has made several experiments on sections of metal taken from crystallized links, trying to find out whether annealing really does completely restore the metal. A series of four tests was made in each of the following cases:

A test bar was prepared from a piece of original stock of Norway iron, which was used in making up several chains. These chains were put in service and subjected to loading in accordance with the tables recommended in handbooks, and after a short time became fatigued and failed. Two test bars were prepared from each side of the failed link, one bar being left in the fatigued condition and the other annealed to a temperature of 1,500 deg. F. These specimens were tested in a tensile machine with the following results. The figures exhibited are an average of four tests in each case.

observed to procure maximum safe conditions in crane chain practice:

1.—Decide upon material desired, low-carbon open-hearth steel or an iron as nearly free from impurities as possible. A pure iron, I believe, is preferable to steel as it makes a better weld than steel, and also an iron link will stretch out to a lock more easily if overloaded, which serves as a telltale for inspection.

2.—Prepare a rigid set of specifications covering the material, workmanship, and tests desired.

3.—Insist on a hand-made link, as the machine made link is bent cold around less than twice its own diameter at a high speed on an elliptical mandrel. This sets up severe initial internal stresses in tension and compression in the outer and inner fiber of the link respectively. The hand-made link is made under a cherry red heat and obviates such stresses; also a far better lap weld is secured in a hand-made link.

Specimen	Elastic Limit (Drop of Beam)	Ultimate Tensile Strength	Per Cent. Elongation	Reduction of Area	Fracture
Original stock	25,600	41,500	48.5	78.4	Cup
Fatigued, not annealed	38,700	46,900	29.0	74.6	Irregular
Fatigued, annealed..	30,000	44,300	47.0	78.3	¾ cup

The chemical analysis of the original stock showed carbon, trace; phosphorus, 0.029 per cent.; sulphur, 0.006 per cent.; manganese, trace; silicon, trace.

A careful examination of the above test data will show that the annealing did not completely restore the original physical qualities of the iron. The writer does not feel that annealing is inadvisable, but is firmly convinced that annealing is not the cure for fatigue. Annealing chains is certainly a good additional safety factor in that it softens the metal and does away with the dangers of a brittle link, but the fact still remains that an annealed chain will undoubtedly fatigue if overloaded, so we are not going to have maximum safety in chain practice by all the proper annealing.

What must be done is to revise the present code of so-called safe loads and base them on the rational basis of the permissible extreme fiber stress of the material used. It is going to be hard to remedy this overloading of chains, as a big misunderstanding has taken deep hold of the average mechanic and user of chains. To convince an old shop hand that a ⅝-in. iron chain should be only worked to 1,600 lb. in straight tension when he has been using it to about 5,000 lb. is indeed a hard proposition, as he feels it is perfectly safe because the chain has carried the load numerous times without failure.

Recommendations

In summarizing the writer feels that the following points should be closely

4.—Number each chain and keep a record of when it goes into service and length of service and class of work it is used for. Inspection should be made daily by a competent and experienced person to detect any reduction of section due to wear, deformation of links and any visible flaws developed in the welds. This is somewhat tedious and expensive, but must be done and done carefully to insure safe operation. A fatigued link has a characteristic metallic ring when struck a sharp blow with a hammer, while a good piece of Norway iron has a decided dull sound when so struck. The writer has found that rings so detected by a metallic ring can be further tested by placing the link edgewise on an anvil and striking it several sharp blows with a sledge. If it is fatigued it will break with a decided crystalline fracture.

5.—Special attention should be given to the design of the ring that connects the chain to the block hook. This ring should be designed to withstand the same load as the chain, using the regular formula for a circular ring under tension in a diametral line.

6.—It is advisable to check up the size of the hook as the writer has found the usual practice of designing a hook is to use the following empirical formula:

$$f = \frac{P}{A} + \frac{Px}{S}$$

Where S = area of critical section S S

This formula is in error in that the second term represents the bending stress calculated from the formula used for straight beams, which, however, does not apply to curved pieces, and the formula given above is not even approximately correct. The correct stress caused by the bending moment can be solved by consulting any standard work on strength of material. The writer has also found many operations where it is necessary to suspend the load on the point of the hook. If there is any possibility of such practice, the hook should be designed accordingly, otherwise the stresses produced will be dangerous.

7.—The last but most important recommendation is:—To subject the chains to a proper load and as an additional safety precaution, anneal them before they are put in service. This annealing though will not prevent fatigue of the metal in case the chains are overloaded, but will merely soften the chains so they will pull to a lock and serve as a telltale for overloading.

It is obvious from the foregoing discussion on the causes of fatigue that annealing at regular intervals is entirely unnecessary, as, if there is any benefit from annealing at all, it will be merely to toughen the metal, and therefore is only necessary once.

From a paper before the National Safety Council Congress at Philadelphia, by E. B. Morgan, safety engineer, Commonwealth Steel Co., St. Louis.

NOVA SCOTIA STEEL CO.

AT a meeting of the directors of the Nova Scotia Steel & Coal Co. at Halifax, N.S., on Nov. 11, the general manager reported that in October the shipments exceeded those of September by 30 per cent., and that unfilled orders on November 1 and material since actually booked would call for 180,000 tons of steel. This is quite apart from the car-building material requirements which are likely to be large. Estimates for the construction of a new open hearth and steel-melting furnace of the largest type were submitted. The management were directed to proceed with construction at once. The new furnace will be ready to produce two hundred tons of steel per day within twelve weeks. Foundation work for the new forging plant is now well advanced.

R. E. Chambers, superintendent of mines, was instructed to resume the underground mining of ore at Wabana immediately, and to continue work throughout the winter at maximum capacity. The export of forged shell blanks is increasing weekly, and further new business for foreign account has been offered the company during the present week. The Eastern Car Company despatched three steamers with cars this week.

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Machine, Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

NEW SHELL BORING LATHE

BEING a matter of vital importance that the output of machine tools for the production of shells should be increased to the maximum, Alfred Herbert, Ltd., Coventry, England, have put in hand large batches of a simple design of turret lathe for shell boring, from which all unnecessary work has been eliminated, and which it is, therefore, possible to build very rapidly. The No. 5 Shell Boring Lathe, as it is called, embodies, nevertheless, a number of valuable features, all of which tend towards high production; the line drawing, Fig. 1, gives a good idea of its general appearance.

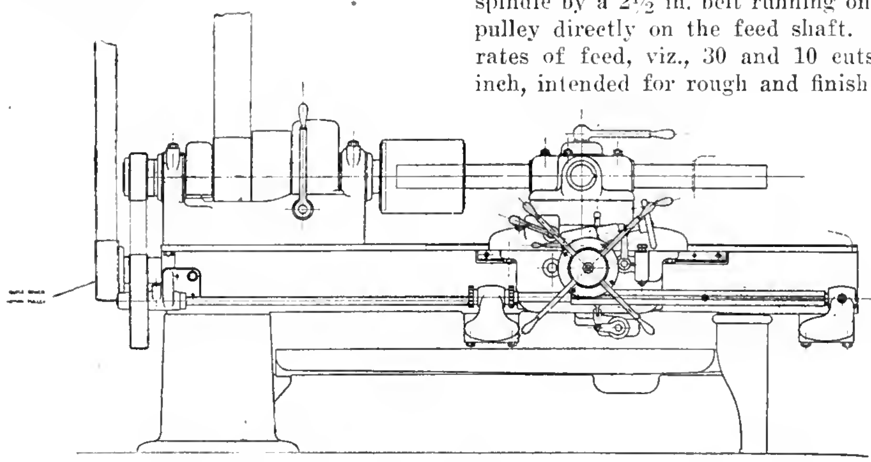


FIG. 1. OUTLINE DRAWING OF NO. 5 SHELL BORING LATHE.

The machine has been designed chiefly for performing the boring and bottoming operations on high explosive shells from 4.5 in. to 6 in. inclusive, but with a suitable tool arrangement it can be used for a number of other operations, such as boring the chamber for the base plug, and forming and facing the closed end of high explosive shells, and also for boring shrapnel shells.

The headstock, which has a height of centres of 10 in., has a large spindle with a 10-in. flange. It has a two-step cone for 5½-in. belt and back gearing of a high ratio. The cone pulley does not drive the spindle direct, but only through the gearing, the spindle being started and stopped by a friction clutch in the main gear, operated by the lever in front of the headstock.

The cone pulley is intended to be driven from a cone formed by putting two split pulleys together on the lineshaft. When used on shell work the lathe is run continually on one spindle speed. The second step of the cone makes it possible to obtain an additional speed by shifting the belt. This is an advantage if an occasional hard forging is met with, and it becomes necessary to slow down the speed.

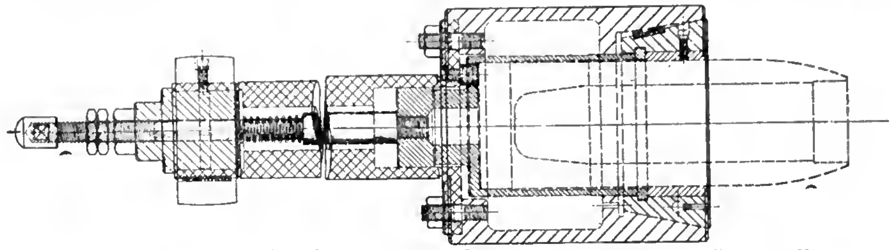


FIG. 2. DRAW-BACK CHUCK FITTED TO NO. 5 SHELL BORING LATHE.

The feed motion is driven from the spindle by a 2½ in. belt running on to a pulley directly on the feed shaft. Two rates of feed, viz., 30 and 10 cuts per inch, intended for rough and finish boring respectively, are obtained by a gear change in the apron.

The turret has four tool holes 3¼ in. diameter, which are provided with keyways. It is rotated by hand and clamped to its seat after indexing by a powerful hand lever. Provision is made for keeping the indexing plunger disengaged, so that the turret may be used with former-controlled bars, if required.

The turret slide has quick power traverse motion along the bed, which is of great service, particularly where female labor is employed. Automatic and dead stops are provided for each hole in the turret, the rotating stop rod being in front of the bed. It has the patent "unison" motion, which allows all the stops to be moved endwise to accommodate variations in the forgings. In addition to the pilot wheel there is a powerful hand feed to the turret by worm gearing for finishing the bottom of the shell bore. An oil pump and piping are included, giving an internal supply to the tools.

A plain reversing countershaft can be furnished as an extra when boring and tapping of shell noses after "bottling" is to be done. As closed-in shells are now being replaced by the "block filled" type with screwed in noses, this extra will hardly ever be required.

The Chuck Feature

The chuck being supplied in conjunction with this machine is shown in the line drawing, Fig. 2, and is of the drawback type. This chuck was designed with a view to making it suitable for employment with female labor.

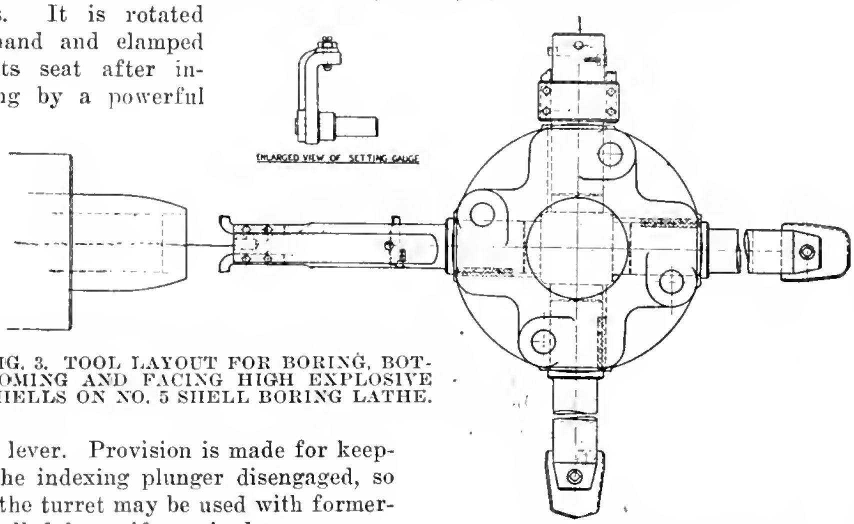


FIG. 3. TOOL LAYOUT FOR BORING, BOTTOMING AND FACING HIGH EXPLOSIVE SHELLS ON NO. 5 SHELL BORING LATHE.

Referring to the line drawing, it will be seen that the body of the chuck is an

iron casting bolted on to the spindle flange, the front end being bored taper to receive the split collet; this is furnished with steel liners, which can be renewed when worn. The collet is pulled back by a steel sleeve which has a collar on the front end fitting in an annular groove in the collet. The back end of this sleeve is bored to fit the closed end of the shell which butts back against a fixed stop screwed into the spindle flange. The location is, therefore, unaffected by variations in the diameter of the shell.

The draw-back rod itself is operated by a hexagon nut at the back end of the spindle, an ordinary spanner being employed for tightening the chuck. The following advantages are claimed for the chuck:—

It holds the work securely under the heaviest bottoming cuts.

It holds the works perfectly true.

It will accommodate a reasonable variation in diameter.

It does not need undue effort to operate.

It is quick to operate.

It has no projecting parts.

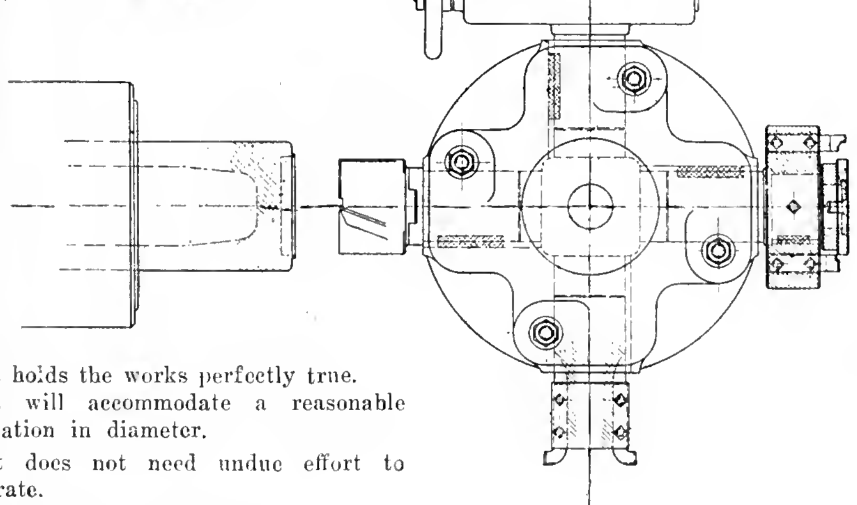
It holds the work without distortion.

Tool Layout

The tool layout for boring, bottoming and facing the latest type of high explosive shells is shown in Fig. 3. Four turret tools are employed, and the first bar which rough bores the parallel portion, has two forged cutters carried in slots at the end, while a round cutter some distance behind takes the first cut in the thread diameter. This type of boring bar is a great producer, and is infinitely superior to a spade tool for parallel boring, as it can be ground with top rake, making it very free cutting, a feed of 30 cuts per inch being used.

For quickly setting the two cutters equidistant from the centre and to the correct size, a setting gauge is provided which fits in a hole at the end of the bar. This is shown in the layout.

FIG. 4. TOOL LAYOUT FOR MACHINING BASE END OF HIGH EXPLOSIVE SHELLS ON NO. 5 SHELL BORING LATHE.



The next tool is a spade drill, which takes up the boring at the point left by the previous bar, and its purpose is to remove the scale from the bottom of the hole. The cutter is approximately to form, but is much easier to feed into the bottom than an ordinary spade tool, owing to the drill point, which cuts through the scale without losing its edge quickly. As it is only a roughing tool, regrinding is quickly done, for the shape is not important, and need not be exactly to form.

The third tool is a spade cutter, correct for diameter and form, which finishes the bore like a reamer, at a feed of 10 cuts per inch, and also trues up the form at the bottom of the shell, the hand worm feed being used for this part of the work, after the automatic feed has tripped. As this cutter has very little to remove, and does not cut on the scale, its life is long, and it seldom needs regrinding.

The last turret bar bores the thread diameter to size, faces the end, and chamfers the mouth. All bars except the last are provided with internal oil supply.

For boring the recess for the base plug, and facing the end, four tools are again used, the layout being shown in Fig. 4. The first is a four-flute reamer cut to centre, which feeds straight into the end of the shell, and roughs out the recess. This is followed by a head carrying two single point cutters for boring to size.

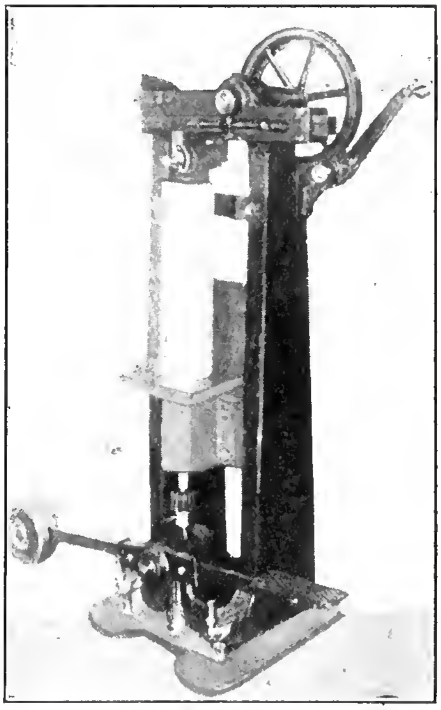
On the next turret face is a head which pilots with a revolving bush into the recess, while two cutters respectively face the end and form the radius.

The facing of the bottom of the recess is done by a traversing single point cutter in the slide facing tool on the last turret face, completing the operations.

MARKING MACHINES FOR HIGH EXPLOSIVE SHELLS

THE photograph herewith illustrates a special machine for marking the base of shells up to 6 in. in diameter and 21½ in. in length. These machines are made in two sizes: Special No. 3A for marking the base of shells up to 12 in., and Special No. 3B for marking the base of shells from 12 in. to 21½ in. in length. The principle involved is the same as the makers Standard Dwight Slate marking machines.

The roll die passes over the base of the shell, and the foot lever raises the table to any desired depth of die so as to give an accurate impression. The No. 3A is arranged with a hand lever, by one pull of which the die revolves and completes the mark. On the No. 3B, in order to get the desired pressure on the larger shells, an arrangement of gears increases the power without increasing the strain on the operator. Shells, it is claimed, can be marked with these machines on the base practically as fast as they can be lifted in and out, as the operation of marking requires only from five to ten seconds. Dies are furnished with these machines to order.



MARKING MACHINE FOR HIGH EXPLOSIVE SHELLS.

The Noble & Westbrook Mfg. Co., Hartford, Conn., are the manufacturers of the foregoing products.

SHELL GROOVING, WAVING AND UNDERCUTTING MACHINE

THE machine shown in the accompanying illustration has been specially designed for cutting, dovetailing and

waving the driving band groove in 4.5 in. and 60-pdr. (5 in.) shells.

The working mechanism is mounted on a short heavy bed cast with an oil pan and mounted on standard legs. Two heavy separate bearings are firmly bolted to the bed; front bearing being $9\frac{3}{4}$ in. diameter x 7 in. long; rear, $5\frac{1}{2}$ in. x 6 in. The bearings are filled with best babbitt, peened in and bored, and finally scraped to fit the spindle. Means of adjustment are provided. The spindle is steel with bearings, etc., finished by grinding on dead centres. The nose or chuck end is fitted with a powerful collet chuck, operated by an air cylinder at the rear end of the spindle.

The drive is through cut gearing from a shaft at the rear, on which is mounted a friction clutch pulley, also operated by air. Two valves are provided so that the chuck or the drive can be operated independently or together.

The feed is through a worm and gear, which in turn connect to cam rods for operating each tool. A knock-out is provided which stops the feed when the proper depth of cut is reached. The cams are drawn back to the starting position by a hand wheel. Independent adjustment is provided for each of the three tools, so that when once adjusted the rear tools reach the finished diameter slightly ahead of the front wave tool. The wave tool is formed to give the correct wave, and is 5 in. long. It is held by clamping into a dovetail by two heavy bolts and sharpened by grinding on end. It is adjusted to the proper height by a set screw below the end of the tool, which prevents any chance of tool moving or slipping out of position. The wave is generated by rocking the tool to follow the wave instead of the usual plan of moving sideways. The movement is positive, as it is controlled by gearing through an eccentric.

The two rear or undercutting tools are very rugged and long-lived, as standard cutting-off tool blades are used, each one 3/16 in. thick by $1\frac{1}{8}$ in. wide. They are clamped into slide blocks set at the correct angle and width for the band groove. All the tools can be taken out, ground and replaced with only one measurement to check—that is, the diameter. This can be corrected with the machine in motion by the adjusting screw which bears on the cam block. The adjustment should be done with the feed out and the point of adjusting screw bearing on the crest of the cam.

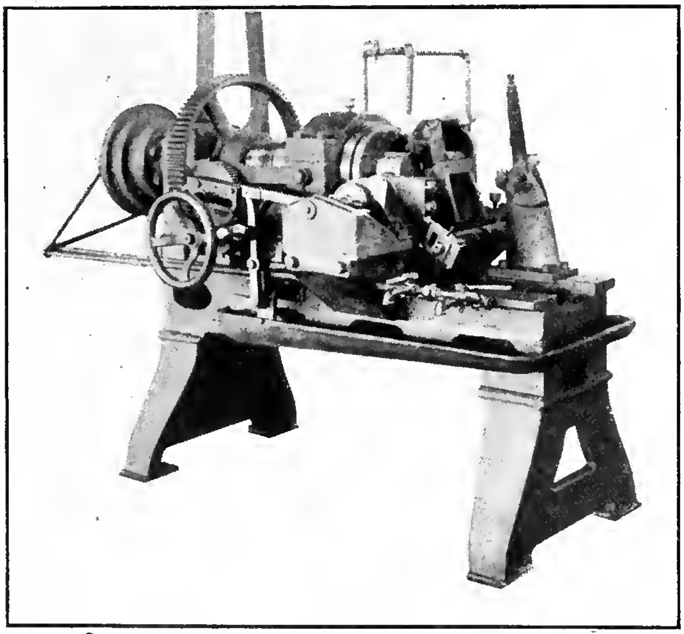
A gear pump is provided, which runs continuously, as it is belted from the driving pulley. Oil or compound is drawn from a reservoir formed in the leg under the bearings. A relief valve is provided to protect pump when in operation.

To operate, place the shell in the shell chuck, swing the stop in place, pull back the shell to the stop, turn on the air for the chuck, then the air for the clutch. Turn the hand wheel until the tools just take hold. Then press down the handle near the hand wheel to raise the worm gear into mesh with the worm on the spindle and turn on the oil. The feed continues until the stop on the front cam rod strikes the knock-off and drops the worm gear out of connection. Shut off the oil and the air from the clutch. Return the cams to original position by rotating the hand wheel. Release the air from the chuck piston and remove the shell.

The machine is semi-automatic in nature, and one operator could easily care for two machines.

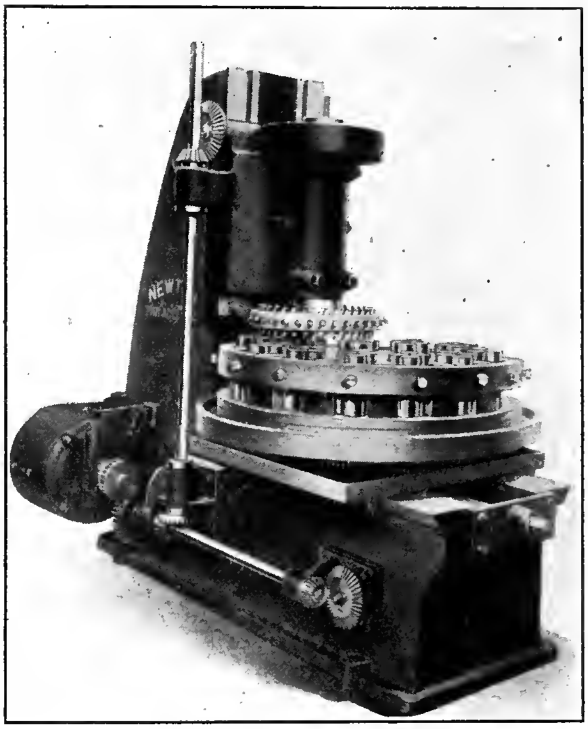
For the 4.5 high explosive shells the pulley shaft should run about 200 r.p.m., at which speed the actual cutting time is 3 minutes 10 seconds. For the 5-in. 60-pdr. shell the pulley shaft should run about 180 r.p.m, the cutting time being 4 minutes 35 seconds. Shells can be taken out and another one chucked in about 30 seconds.

This machine is a recent product of the Jenckes Machine Co., Sherbrooke, Que.


SHELL GROOVING, WAVING AND UNDERCUTTING MACHINE

VERTICAL MILLING MACHINE WITH UNINTERRUPTED FEED

THIS description refers to a vertical milling machine which was built by the Newton Machine Tool Works, Philadelphia, Pa., specially for milling off the solid ends of shrapnel. While the machine in itself is not a new development, the adaptation of the special chuck or fixture for holding the work makes a continuous operation. A 10 in. diameter cutter is carried, and the finished work can be removed and rough shells clamped in the fixture without stopping the feed.



VERTICAL MILLING MACHINE

The method of procedure is to hold the rough turned forgings in the fixture which has a capacity for holding sixty pieces at a time. This is subdivided into pockets, each being arranged to hold five forgings which are clamped with one screw. The work table has three changes of circular feed with hand circular rotation and hand in-and-out adjustment.

Papers Read at the Recent Foundrymen's Convention

Selected from the more important subjects presented for discussion before the Annual Convention of the American Foundrymen's Association and the American Institute of Metals at Atlantic City, N.J., during September, 1915. The papers cover a wide field of foundry and allied activity, the nature of the results and the completeness of the reports making them of particular interest to all who desire to keep in touch with metallurgical progress.

CONCERNING "STELLITE"

By Elwood Haynes.*

THE name STELLITE was coined from the Latin word "Stella," a star. This name was first applied to a binary alloy consisting of cobalt and chromium, which the writer discovered and produced as early as 1899. It was not until some years later that its properties were fully investigated, when it was found to possess the following properties:

1. A considerable amount of hardness, as alloys containing 10 per cent. or more of chromium could not be successfully filed, though the file could slowly wear away the suface of the metal.

2. Considerable toughness. Alloys containing as high as 25 per cent. chronium showing elongation of 10 per cent. or more.

3. Comparatively high tensile strength and elastic limit. A bar of forged metal showing elastic limit of 85,000 pounds and tensile strength of 110,000 pounds.

4. Fine color and lustre. The color of the alloy lies between that of steel and silver.

5. Absolute resistance to oxidation or other changes when exposed to either dry or moist atmosphere at all temperatures under a dull red heat.

In 1911 the writer succeeded in producing very hard alloys (consisting essentially of cobalt and chronium) by adding tungsten or molybdenum or both. The hard alloys thus formed could not be scratched with the file, but in turn would scratch any steel that could be produced. Some of these alloys were extremely brittle, and those used for lathe tools require very careful handling. Some of them that showed excellent cutting qualities when used for turning cast iron or steel would break very easily if subjected to any abnormal stress.

In order to determine the stress required to break a 3/8-in. sq. tool, for example, a small clamp was made in the form of a slot precisely similar to the slot used in the tool holder.

A short piece or bar of Stellite was placed in this slot and pressure applied vertically near the end of the bar at a distance of 1 in. from the clamp. Some of the weaker bars broke at from 100 to 300 pounds pressure under this test. Gradually the strength of the bars was increased until they would readily withstand 1000 pounds, and at this time bars are produced for turning steel which readily withstand from 1,200 to 1,500 pounds under the same test. The very hard bars used for turning cast iron usually stand from 800 to 1,200 pounds under this test. Bars that would stand as high as 1,850 pounds have been produced, but were not found to be equal in cutting qualities to some other compositions of slightly less strength. It should be remarked at this point that the cutting qualities of any steel do not depend primarily upon its strength, but upon the suitable combination of strength, hardness, resistance to wear, etc. The strength of a tool is in reality a question of elastic limit. Steels possessing this quality to the highest degree are nickel steels, nickel chrome steels and vanadium chrome steels. For turning steel and iron, however, they are of little or no value, since they lack in hardness and resistance to abrasion, particularly at high temperature.

Maintaining the Cutting Edge

The virtue of the Stellite tool lies in its ability to maintain its cutting edge at a high rate of speed at temperatures which would immediately cause the failure of any known tools containing any notable quantity of iron. Its great hardness and resistance to abrasion at all working temperatures are likewise valuable properties.

Owing to the fact that Stellite retains its hardness even at a full red heat, it cannot be forged. This fact, however, is rather a virtue than a detriment so far as use is concerned, because if the alloy would soften sufficiently for forging when heated it would, of course, immediately lose its cutting edge at the same temperature and this would limit its usefulness to a marked degree.

A Recent Performance

From the above fact Stellite can only be reduced to the desired form by casting it in dies in the form of bars which are afterward ground to a cutting edge. Its capabilities as a lathe tool are now universally acknowledged, though in certain cases failures have resulted, due to improper knowledge of the alloy and its peculiarities. It should be remembered that it is not a steel and therefore requires special handling, which enables the operator to utilize its valuable properties to the best advantage.

Without going into the method of handling the alloy, some results obtained by its use may not be out of place. It was recently ascertained that a 3/8-in. sq. x 2½-in. long piece of Stellite, ground to the form of a grooving tool, cut 14,000 grooves in cast iron pistons ranging from 3½ in. to 4⅜ in. in diameter before it became too much worn off for further use. This work was performed in regular practice and not as a test. A still more remarkable and more recent performance has just come to light in the same factory. A Stellite tool of the same dimensions as that mentioned above, but which was ground to the round nose form and used for turning pistons, turned off more than 8,000 pounds of cast iron before becoming too short for use. Considering only the portion of the tool which was actually ground away, the tool turned off 1,000 times its weight of cast iron before becoming too short for service.

Both of the above tools were made especially for turning cast iron. Another combination is used for turning steel, which has also shown equally remarkable results. These tools are now being used extensively for turning shrapnel shells at high speed for the European war.

While long wear is an important property in a lathe tool, it is not the essential or most valuable property. The value of the tool, even at the comparatively high price of Stellite sinks into insignificance when compared with the value of the time saved. For example, in the cast iron performance mentioned above, the Stellite cost only about 1c per day, while it effected a net saving of from \$2 to \$3 per day. In other words, it is the value of the output which counts and not the cost of the tool.

*Haynes Stellite Works, Kokomo, Ind.

FOUNDRY EXHIBITION OF 1916

A. O. BACKERT, secretary American Foundrymen's Association, has issued the following statement in his capacity as secretary of a special committee of the American Foundrymen's Association and the American Institute of Metals. Details of the new arrangement for the annual exhibition of foundry equipment and supplies are given in the following letter addressed to the members of the American Foundrymen's Association:

As a result of several conferences, held recently at Cleveland and Pittsburgh, by the special committee empowered by the American Foundrymen's Association and the American Institute of Metals to select the time and place

for the 1916 foundrymen's convention, it has been decided to meet in Cleveland during the week of September 11.

At Atlantic City the executive board of the American Foundrymen's Association authorized the appointment of a committee of five to decide upon next year's meeting place, and this committee was instructed by the American Institute of Metals to serve also in its behalf. This special committee is constituted as follows: R. A. Bull, Commonwealth Steel Company, Granite City, Ill., president of the American Foundrymen's Association, chairman; Joseph T. Speer, Pittsburgh Valve, Foundry & Construction Company, Pittsburgh, and Alfred E. Howell, Phillips & Buttorff Mfg. Company, Nashville, Tenn., past presidents; J. P. Pero, Missouri Malleable Iron Company, East St. Louis, Ill., senior vice-president, and A. O. Backert, Cleveland, secretary American Foundrymen's Association.

The annual exhibition of foundry equipment and supplies, to be held concurrently with the meetings of these organizations, will be conducted under the auspices of the American Foundrymen's Association and the American Institute of Metals. This decision was reached after mature deliberation and represents the unanimous action of the members of this special committee. It also has been approved heartily by J. S. Seaman, Seaman-Sleeth Company, Pittsburgh, past president of the American Foundrymen's Association, and Jesse L. Jones, Westinghouse Electric & Mfg. Company, East Pittsburgh, Pa., president of the American Institute of Metals, with whom the members of the special committee met for counsel.

Since the interests of manufacturers of foundry equipment and supplies, who make exhibits at these annual shows, and the members of the American Foundrymen's Association and the American Institute of Metals are mutual, it is the sentiment of this special committee that the exhibitors should share in the profits, to be paid in the form of rebates on the cost of their space.

The exhibition will be held in the Cleveland Coliseum, located on Thirteenth Street, in the centre of Cleveland's business district. The Coliseum is within one block of the Hotel Statler, three blocks from the Hollenden, and is only a short walking distance from the other Cleveland hotels. It contains 60,000 sq. ft. of floor space on one level and is admirably adapted for a foundry show.

Sealed proposals have been invited from corporations and individuals capable of conducting exhibits, which are to be submitted to the secretary of this special committee, A. O. Backert, Twelfth and Chestnut Streets, Cleveland, Ohio, on or before 12 o'clock noon, Eastern time, Saturday, November 13, 1915.

This communication has been authorized by this special committee, and its secretary has been instructed to notify you of the action taken.

RE-SHARPENING OF FILES

IN a paper entitled "Machine Shop Equipment, Methods and Processes," before the recent International Engineering Congress, E. R. Norris described the operations involved in re-sharpening files as follows:—

A sand blasting apparatus is being successfully used for file sharpening, by several large manufacturing establishments. This consists of a sheet-iron chamber provided with uptake, settling tank, slurry mixing-tank, slurry overflow pipe, air agitating pipe and slurry projector. A door gives access to the inside of the chamber. The slurry projector is inclined to the horizontal at an angle of 25 deg., and the nozzle extends slightly within the chamber. The projector consists essentially of a bronze body to which are fitted steam pipe, slurry suction-pipe and nozzle. The steam supplies sufficient water for the slurry.

The files are sharpened by being held in the slurry jet in such a manner as to expose the backs of the file teeth to the cutting action of the sand. When the file has been sharpened, it is cleaned and dried by the steam, after the slurry supply has been cut off by a foot lever.

Success in file sharpening depends on the skilful selection of the files to be sharpened, maintenance of the correct angle between files and jet while sharpening, and the selection of a suitable sand. Experience shows that a sharpened file often does as much work as a new one, and the cost of sharpening averages about one-fifth of the cost of new files. The following results have been obtained under ordinary manufacturing conditions and may be taken as representative of the economies which are effected by the efficient use of this apparatus.

No. of Files Treated		Size, In.	Total cost Sand Blasting	Recut Price	Price of New Files
109	...	4	$ 0.88	$	$11.99
1245	...	6	9.96	....	136.95
1333	...	8	14.20	....	199.95
943	...	10	15.07	56.00	169.74
1206	...	12	28.98	96.48	241.20
831	...	14	26.69	99.72	174.51
566	...	16	22.64	90.56	124.52
143	...	18	6.28	27.17	34.32

GAS ENGINE EFFICIENCY

AT full load under the most favorable conditions, the indicated horsepower of a gas-engine is 88 per cent. of that of an ideal-engine working with a similar mixture. This holds true for all except very weak mixtures; for which the relative efficiency is lower. For mixtures containing only a slight excess of air, the above corresponds to an absolute thermal efficiency of 27 per cent. at a compression ratio of 3.75, and 33 per cent. at a compression ratio of 5.6; for mixtures containing twice the amount of air required for complete combustion the absolute efficiencies are 29 per cent. and 36 per cent. The indicated efficiency relative to the gas-standard falls from 88 per cent. to 84 per cent. between full and no load.

At full load, the brake efficiency reative to the gas-standard varies from 70 per cent. at the compression ratio 3.75, to 67.5 per cent. at the compresion ratio 5.6; this holds true for all except the weakest mixtures, for which the relative efficiency is lower. The absolute brake efficiency is 21 per cent. at compression ratio 3.75, and 25.5 per cent. at compression ratio 5.6 for mixtures containing little excess of air, and 23 per cent. and 27 per cent. respectively for mixtures containing twice the amount of air required for complete combustion. The maximum brake efficiency obtained in the author's experiments was 27.4 per cent., and this occurred at the highest compression ratio for a mixture slightly stronger.

At light loads, the brake efficiency relative to the gas-standard decreases more rapidly as the compression ratio rises. For the higher compression ratios the increase of theoretical efficiency is just counterbalanced by the increase in frictional loss, and thus the absolute efficiency remains constant.

The mechanical losses increase slightly in absolute amount with the load and with the compression ratio. For the engine under test (a 25 h.p. National gas engine) at normal speed (200 revs. per min.) the mechanical losses amounted to 5.6 h.p. at no load and 6.3 h.p. at full load when the compression ratio was 3.75; and 6.5 h.p. at no load and 7.0 h.p. at full load when the compression ratio was 5.6. The pumping losses were an important part of the total mechanical losses; at a compression ratio of 4.85 they represented 2.3 h.p. at no load and 2.1 h.p. at full load, or 38 and 31 per cent. of mechanical losses.

The loss of power due to thermal losses at full load under most favourable conditions amounted to 12 per cent. of the total available energy, and at no load to 16 per cent.; of this less than one quarter was due to heat transmission during the expansion.

From a paper read at the recent British Association meeting.

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IS A STEEL FAMINE REALLY IMMINENT?

IF the unexpected always happens, it might reasonably be argued that the expected never happens. Present reports and future prospects, however, would seem to justify many of the assertions which are being made regarding the inability of steel makers to meet the present demand, although, whether the demand is liable to increase still further, is at the moment largely conjecture.

As the largest producer of steel in the world, the United States is enjoying a period of unprecedented activity. That this activity is directly due to the war there can be no doubt, for while many observers credit the scarcity of steel to a greatly increased home consumption, it is obvious that much, if not nearly all of this domestic activity in the States developed after the placing of war contracts by the belligerents.

Reports as to the actual rate at which munition and other contracts calling for steel are being filled are not available for obvious reasons, but, if judged by the experience of manufacturers in this country, production should be well on to the maximum. It is true that an increase in Canadian consumption may result from the recently placed contracts for large shells, but that such an increase will result in a state of affairs approaching a steel famine seems hardly probable.

The uncertainty regarding developments in the war during the next few months is sufficient to prevent accurate forecasting of the industrial situation. The success which has attended the organization of national arsenals and controlled munitions plants in Great Britain is reducing the tendency to distribute shell orders broadcast as has been done recently. Consequently, when the present high peak of production has been passed, the consumption on this account may be expected to decrease.

The recent arrival on this side of the ocean of French Government officials regarding the assistance which could be rendered by American firms in the ultimate period of construction points to a possible continuance of consumption which, under the circumstances, might be of extended duration rather than of excessive urgency. The fact that British steel makers are extending their plants with all possible haste should not be lost sight of in its bearing on the steel market in this country.

While many furnace companies are endeavoring to place further orders for ore, indicating the probability of a shortage on docks during the winter, British firms are able to procure a steady supply of ore from Spain with which to increase their output. The close contact of Belgian, French and British officials and manufacturers discounts the probability of reconstruction opportunities being overlooked or suffering from lack of preparation by European manufacturers. The recovery of the Minette ore mines and the Alsace deposits by France will stimulate manufacturing in many ways, but as by that time, the demand for munitions may have decreased somewhat, the present highly organized industry of France may well be expected to resume production promptly and largely.

The nature of financial relations between Europe and America may not be without a retarding effect on the future steel trade between the two continents. The necessity for observing every available financial and industrial economy is becoming more apparent every day, and even later, when the tide of events is undeniably set towards Allied triumph, the necessity for economy will not be any less urgent.

Under these circumstances, and in the absence of further immediate increases in domestic consumption, the supply of steel may not fall so far short of the demand as to assume the nature of an absolute famine.

The commercial activity throughout the country which results from and reacts upon the steel industry in times like the present creates demands which do not partake of the urgency of war orders. Additions to rolling stock, building operations, county and municipal improvements, and many other undertakings of a similar kind are limited in their rate of progress by the cost of construction. The dull times in Canada and the United States which preceded the war, prevented the placing of much business, which, had it been gone on with, would have caused the present situation to be much more acute.

The highest bidder does not always get the material, and just as some firms across the line have an eye to their own permanent customers, to the refusal of export business, so will Allied interests encourage the formation of connections which, while of more than urgent necessity at the present moment, will later assume an economic value out of all proportion to their present cost.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey forge, Pittsburgh	$15 95	
Lake Superior, charcoal, Chicago	17 25	
Ferro nickel pig iron (Soo)	25 00	
	Montreal.	**Toronto.**
Middlesboro, No. 3	$24 00	.....
Carron, special	25 00	.....
Carron, soft	25 00	.....
Cleveland, No. 3	24 00	.....
Clarence, No. 3	24 50	.....
Glengarnock	28 00	.....
Summerlee, No. 1	30 00	.....
Summerlee, No. 3	29 00	.....
Michigan charcoal iron.	28 00	.....
Victoria, No. 1	24 00	21 75
Victoria, No. 2X	23 00	21 75
Victoria, No. 2 plain..	23 00	21 75
Hamilton, No. 1.......	23 00	21 75
Hamilton, No. 2.......	23 00	21 75

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	**Cents.**
Common bar iron, f.o.b., Toronto..	2.50
Steel bars, f.o.b., Toronto........	2.75
Common bar iron, f.o.b., Montreal	2.50
Steel bars, f.o.b., Montreal	2.75
Twisted reinforcing bars	2.55
Bessemer rails, heavy, at mill....	1.25
Steel bars, Pittsburgh	...
Tank plates, Pittsburgh	...
Beams and angles, Pittsburgh....	...
Steel hoops, Pittsburgh	1.75
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.50
Small shapes	2.75
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	2.20
Structural shapes	2.20
Plates	2.20

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal	Toronto
Plates, ¼ to ½ in., 100 lb.	$2 35	$2 35
Heads, per 100 lb.	2 60	2 60
Tank plates, 3-16 in.	2 70	2 70

OLD MATERIAL.

Dealers' Buying Prices.	**Montreal.**	**Toronto.**
Copper, light	$12 75	$12 75
Copper, crucible	15 25	15 00
Copper, unch-bled, heavy	14 75	14 50
Copper, wire, unch-bled..	14 75	14 50
No. 1 machine compos'n	11 75	11 75
No. 1 compos'n turnings	10 25	10 00
No. 1 wrought iron	10 00	9 50
Heavy melting steel	9 00	9 00
No. 1 machin'y cast iron	13 50	13 00
New brass clippings....	11 00	11 00
No. 1 brass turnings....	9 00	9 00
Heavy lead	5 00	5 00

Tea lead	$ 4 00	$ 4 00
Scrap zinc	12 50	12 00

W. I. PIPE DISCOUNTS.

Following are Toronto jobbers' discounts on pipe in effect Nov. 5, 1915:

	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
Standard				
¼, ⅜ in.	62	38½	....	....
½ in.	67	47½	....	....
¾ to 1½ in. ..	72	52¼	....	....
2 in.	72	52½	68	48½
2½ to 4 in. ...	72	52½	71	51½
4½, 5, 6 in...	....	....	69	49½
7, 8, 10 in. ...	....	....	66	44½
X Strong P. E.				
¼, ⅜ in	55	38½	....	....
½ in	62	45½	....	....
¾ to 1½ in. ..	66	49½	....	....
2, 2½, 3 in. ..	67	50½	....	....
2 in.	....	....	62	45½
2½ to 4 in ..	....	....	65	48½
4½, 5, 6 in. ..	....	....	65	48½
7, 8 in	....	....	58	39½
XX Strong P. E.				
½ to 2 in	43	26½	....	....
2½ to 6 in. ...	....	....	42	25½
7 to 8 in.	....	....	39	20½
Genuine Wrot Iron.				
⅜ in	56	32½	....	....
½ in	61	41½	....	....
¾ to 1½ in. ..	66	46½	....	....
2 in.	66	46½	62	42½
2½, 3 in.	66	46½	65	45½
3½, 4 in.	....	....	65	45½
4½, 5, 6 in. ..	....	....	62	42½
7, 8 in.	....	....	59	37½

Wrought Nipples.	
4 in. and under	77½%
4½ in. and larger	72%
4 in. and under, running thread.	57½%
Standard Couplings.	
4 in. and under	60%
4½ in. and larger	40%

MILLED PRODUCTS.

Sq. & Hex Head Cap Screws	65 & 5%
Sq. Head Set Screws	70 & 5%
Rd. & Fil. Head Cap Screws.....	45%
Flat & But. Head Cap Screws....	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in.	70%
Semi-Fin. Nuts up to 1 in.	70%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

METALS.

	Montreal.	Toronto.
Lake Copper, carload ...	$21 00	$20 50
Electrilytic copper	21 00	20 25
Castings, copper	20 50	20 25
Tin	48 00	48 00
Spelter	20 00	21 00
Lead	6 75	7 00
Antimony	42 00	40 00
Aluminum	62 00	65 00

Prices per 100 lbs.

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh...	$27 00
Open-hearth billets, Pittsburgh..	28 00
Forging billets, Pittsburgh	48 00
Wire rods, Pittsburgh	37 00

NAILS AND SPIKES.

Standard steel wire nails, base	$2 60	$2 55
Cut nails	2 50	2 70
Miscellaneous wire nails..	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	70
Stove bolts	80
Plate washers	40
Machine bolts, ⅜ and less	65
Machine bolts, 7-16 and over....	50-7½
Blank bolts	50-7½
Bolt ends	50-7½
Machine screws, iron, brass.....	35
Nuts, square, all sizes ....3¾c per lb off	
Nuts, hexagon, all sizes...4¼c per lb. off	
Iron rivets	72½
Boiler rivets, base, ¾-in. and larger	$3.75
Structural rivets, as above	3.75
Wood screws, flathead, bright ....85, 10, 7½, 10 p.c. off	
Wood screws, flathead, brass ....75 p.c. off	
Wood screws, flathead, bronze ....70 p.c. off	

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Standard. Price, per ft.	Extra Strong. Sizes Ins.	Extra Strong. Price per ft.	D. Ex. Strong. Size Ins.	D. Ex. Strong. Price per ft.
⅛in	$.05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1¼in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	....
7 in	2.38	7 in	3.81	....	....
8 in	2.50	8 in	4.34	....	....
8 in	2.88	9 in	4.90	....	....
9 in	3.45	10 in	5.48	....	....
10 in.	3.20	....	....	....	....
10 in.	3.50	....	....	....	....
10 in.	4.12	....	....	....	....

COKE AND COAL

Solvay Foundry Coke	$6.25
Connellsville Foundry Coke	5.65
Yough Steam Lump Coal	3.63
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

COLD DRAWN STEEL SHAFTING.

At mill	30%
At warehouse	20%

Discounts off new list. Warehouse price at Montreal and Toronto.

MISCELLANEOUS

Solder, half-and-half	0.25
Putty, 100-lb. drums	2.70
Red dry lead, 100-lb. kegs, per cwt.	9.65
Glue, French medal, per lb.	0.15
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.23½
Benzine, single bbls., per gal.	0.23
Pure turpentine, single bbls.	0.85
Linseed oil, raw, single bbls.	0.85
Linseed oil, boiled, single bbls.	0.88
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.50
Lead Wool. per lb.	0.11
Pure Manila rope	0.16
Transmission rope, Manila	0.20
Drilling cables, Manila	0.17
Lard oil, per gal	0.73
Union thread cutting oil	0.60
Imperial quenching oil	0.35

POLISHING DRILL ROD

Discount off list, Montreal and Toronto 40%

PROOF COIL CHAIN.

¼ in.	$9.00
5-16 in.	5.90
⅜ in.	4.95
7-16 in.	4.65
½ in.	4.40
9-16 in.	4.05
⅝ in.	4.30
¾ in.	4.15
⅞ inch	3.65
1 inch	3.45

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	55
Carbon over 1½ in.	25
High Speed	
Blacksmith	55
Bit Stock	60 and 5
Centre drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Centre	25
Pipe Reamers	80

Discounts off standard list.

IRON PIPE FITTINGS.

Canadian malleable, A, 25 per cent.; B and C, 35 per cent.; cast iron, 60; standard bushings, 60 per cent.; headers, 60; flanged unions, 60; malleable bushings, 60; nipples, 75; malleable, lipped unions, 65.

TAPES

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3.50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$3 30	$3 00
Canada plates, dull. 52 sheets	3 15	3 15
Canada Plates, all bright	4 60	4 75
Apollo brand, 10¾ oz. galvanized	5 50	4 80
Queen's Head, 28 B.W.G.	6 00	5 95
Fleur-de-Lis, 28 B. W. G.	5 75	5 75
Gorbal's Best, No. 28	6 00	6 00
Viking metal, No. 28	5 25	5 25
Colborne Crown, No. 28	5 70	5 80
Premier No. 28	5 40	5 20

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$14 25	.....
1¼ in.	15 00	.....
1½ in.	15 00	.....
1¾ in.	15 00	.....
2 in.	15 00	.....
2¼ in.	16 50	9 25
2½ in.	17 50	10 50
3 in.	25 00	12 25
3½ in.	28 00	14 50
4 in.	33 00	18 50

Prices per 100 feet, Montreal and Toronto.

WASTE.

WHITE.	Cents per lb.
XXX Extra	0 11½
X Grand	0 11
XLCR	0 10¼
X Empire	0 09½
X Press	0 08¾
COLORED.	
Lion	0 07¾
Standard	0 07
Popular	0 06¼
Keen	0 05½
WOOL PACKING.	
Arrow	0 17
Axle	0 12
Anvil	0 09
Anchor	0 07
WASHED WIPERS.	
Select White	0 08½
Mixed Colored	0 06¼
Dark Colored	0 05¼

This list subject to trade discount for quantity.

BELTING RUBBER

Standard	50%
Best grades	30%

BELTING—NO. 1 OAK TANNED.

Extra heavy, single and d'ble,	40 & 10%
Standard	50%
Cut leather lacing, No. 1	$1.20
Leather in sides	1.10

ELECTRIC WELD COIL CHAIN B.B.

⅛ in.	$12.75
3-16 in.	9.00
¼ in.	6.00
5-16 in.	4.75
⅜ in.	3.75
7-16 in.	3.75
½ in.	3.75
⅝ in.	3.60
¾ in.	3.60

Prices per 100 lbs.

PLATING CHEMICALS

Acid, boracic	$ .15
Acid, hydrochloric	.05
Acid, hydrofluoric	.06
Acid, nitric	.10
Acid, sulphuric	.05
Ammonia, aqua	.08
Ammonium carbonate	.15
Ammonium chloride	.11
Ammonium hydrosulphuret	.35
Ammonium sulphate	.07
Arsenic, white	.10
Copper sulphate	.10
Cobalt sulphate	.50
Iron perchloride	.20
Lead acetate	.16
Nickel ammonium sulphate	.10
Nickel carbonate	.50
Nickel sulphate	.15
Potassium carbonate	.40
Potassium sulphide (substitute)	.20
Silver chloride (per oz.)	.65
Silver nitrate (per oz.)	.45
Sodium bisulphite	.10
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.35
Sodium hydrate	.04
Sodium hyposulphite (per 100 lbs.)	3.00
Sodium phosphate	.14
Tin chloride	.45
Zinc chloride	.20
Zinc sulphate	.07

Prices Per Lb. Unless Otherwise Stated.

ANODES

Nickel	.47 to .52
Cobalt	1.75 to 2.00
Copper	.22 to .25
Tin	.45 to .50
Silver	.55 to .60
Zinc	.22 to .25

Prices Per Lb.

PLATING SUPPLIES

Polishing wheels, felt	1.50 to 1.75
Polishing wheels, bullneck.	.80
Emery in kegs	.4½ to .06
Pumice, ground	.05
Emery glue	.15 to .20
Tripoli composition	.04 to .06
Crocus composition	.04 to .06
Emery composition	.05 to .07
Rouge, silver	.25 to .50
Rouge, nickel and brass	.15 to .25

Prices Per Lb.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., Nov. 22, 1915—Optimism arising from the harvesting of a record crop continues to develop, and the general feeling is that even should the demand for war supplies tend in coming months to show a falling off and ultimately cease, an era of industrial prosperity is in process of materializing. The turn of the year is expected to bring about much activity in railroad betterment and shipbuilding, the latter probably attaining a prominence hitherto unknown in Canadian experience.

Pig Iron

The demand for pig iron for steel making continues to tax the blast furnaces to capacity. Producers are filled up with orders for months ahead and are not inclined to take futures until they see the effect that the present conditions will have upon the market. Some are holding out on orders with the expectation that higher prices will prevail. Local dealers have not further advanced prices, but state that an increase may be made before the close of the present month.

Steel

Last week's action of the United States Steel Corporation in withdrawing quotations on foreign trade, does not mean that this condition of affairs will prevail for any great length of time, as similar steps have been taken in the past when domestic conditions showed signs of congestion. The present situation is the result of most of the mills being booked up several months ahead and because many of them are unable to give delivery until well into the first half of the coming year. The needs of the war have taken precedence over the domestic demand, and the latter is therefore suffering to some extent.

United States quotations show advances, but locals remain unchanged. However, all indications are that prices will show sharp advances in the immediate future.

The abnormal demand for high speed steel is putting this necessary material almost beyond the reach of the manufacturer. Present quotations range from \$2.50 to \$3.00 per pound.

The demand for sheets continues brisk, with prices unchanged.

Machine Tools and Supplies

Little or no change is noted in the machine tool situation. The demand for certain tools continues, but with uncertainty of delivery. Many shell-making establishments are receiving machines which were ordered six or eight months ago, and supplementary machinery is being secured wherever possible.

Within the next two or three months, those firms successful in securing orders for the large shells will be equipping plants with heavy tools, suitable for the work.

Metals

The metal situation is gathering strength and quotations are advancing. Heavy demands and increased activity in the copper trade is responsible for the advance of the past week. The abnormal consumption of copper by the large manufacturing centres far exceeds that of any previous record.

Copper—Producers are beginning to feel the strain of the demand for copper, and the Lake companies have, in some instances, declined to give quotations, as they carry orders that will take many months to fill. Many of the buyers for war purposes are not yet satisfied, and further advances are looked for. Domestic demand is below normal. A general advance of 1c per lb. is shown in this week's figures. Lake copper, carload and electrolytic is quoted at 21 cents per pound, while casting has advanced to \$20.50 per hundred pounds.

CANADIAN GOVERNMENT PURCHASING COMMISSION

The following gentlemen constitute the Commission appointed to make all purchases under the Dominion \$100,000,000 war appropriation:—George F. Galt, Winnipeg; Hormidas Laporte, Montreal; A. E. Kemp, Toronto. Thomas Hilliard is secretary, and the commission headquarters are at Ottawa.

Tin—Developments in the tin situation are keeping the markets in a state of uncertainty. Conditions in the Mediterranean and the Suez Canal continue to keep prices strong. The advance of \$7 noted in last week's quotations is this week increased another \$3, making an increase of \$10 per 100 lbs. in two weeks.

Spelter—This keeps very firm with advances shown in all quarters. The scarcity shown in London lately has resulted in an advance in price, and immediate delivery is securing good figures. Future delivery is also holding firm. Local dealers have advanced their prices \$20 per ton and are now quoting 20 cents per lb.

Lead—Local dealers report firmness with the usual activity and a slight advance over the previous week. Present price per 100 pounds is \$6.75.

Antimony—This is still showing a tendency to advance. Buying is heavy, due to the increased call of war munitions. This week shows an advance to \$42 per hundred pounds.

Aluminum—This keeps firm at 62 cents per pound.

Old Materials

Dealers in scrap metals report business normal, with no advance in prices. However, the situation may call for many changes before the close of the present week. The advances shown in the various metals will naturally have their effect upon old material and increases are looked for shortly.

Toronto, Ont., Nov. 23.—The greatest activity continues in the steel trade and munitions industry, while the industrial situation generally is looking brighter. Both domestic and export trade is improving and there is a more optimistic feeling with regard to the future outlook. Conditions are to a considerable extent abnormal, and the slackening in trade usually experienced during the winter months will probably not be so noticeable this year. War orders will assist materially in keeping factories busy and make up for loss of normal business. Indications point to considerably less unemployment this winter and to improved economic conditions throughout the country.

That the export trade continues to increase in volume is clearly shown in the trade returns for October recently issued by the Department of Trade and Commerce. The exports for the month were valued at eighty million dollars, or nearly double those for the corresponding month of 1914. The total Canadian trade for October, 1915, was eleven million dollars ahead of October, 1914, while for the seven months of this fiscal year the increase is sixty-nine million dollars more than for the corresponding period of last year. An interesting feature of the business expansion is the continued improvement in the balance of trade towards this country.

The situation with regard to the munitions industry is practically unchanged. Orders for the large calibre shells are being placed, but in what quantities is not generally known. The Munitions Committee has fixed the price of steel for shells at 3½ cents per pound. A shortage of copper bands has developed and is causing considerable inconvenience to some firms working on shells.

Successful Production of 4.5 in. Shells in a Stove Foundry

Staff Article

Shell making in Canada has passed well beyond the novelty stage and may easily be designated as having assumed a place of prominence comparable with the most outstanding and successful of our hitherto established metal-working industries. In many instances, output of finished shells is being developed to such an extent to meet the requirements of our Munitions Committee, that the regular lines of the firms engaged have almost ceased to exist.

THE plant from which this article was obtained is still engaged in stove-making, but their greatest meantime activity, like many other concerns, is in the manufacture of 4.5 in. high explosive shells.

Having little or no machinery with which to commence shell operations, it was some time before much progress was apparent; but after several months of preparation, a large store house, adjacent to the foundry, was equipped with machine tools suitable for the purpose, and in a short time an output of 400 finished shells per day is expected.

The present plan of the machine tool layout is shown in Fig. 1. The larger section of the building is one storey high, the portion to the left being of two-storey construction. It is intended to move the tool room to the floor above and use this space for additional manufacturing equipment

In the plan layout the numbers indicate the various operations on the shells as they proceed through the shop:—(1) Cut off and face base; (2) Centre base; (3) Rough turn; (4) Boring; (5) Face base; (6) Nosing; (7) Bore and thread nose: (8) Rough outside diameter and contour; (9) Finish outside diameter and contour; (10) Grind; (11) Weigh and test; (12) Doctoring; (13) Rough groove; (14) Wave and undercut; (15) Rough and base; (16) Finish base and recess; (17) Rivet base plate; (17A) Saw off square; (18) Face and finish base; (18A) Brass sockets; (19) Press on copper band; (20) Turn copper band; (21) Marking base; (22) Sand blast; (23) Varnishing; (24) Baking; (25) Inspection; (26) Painting.

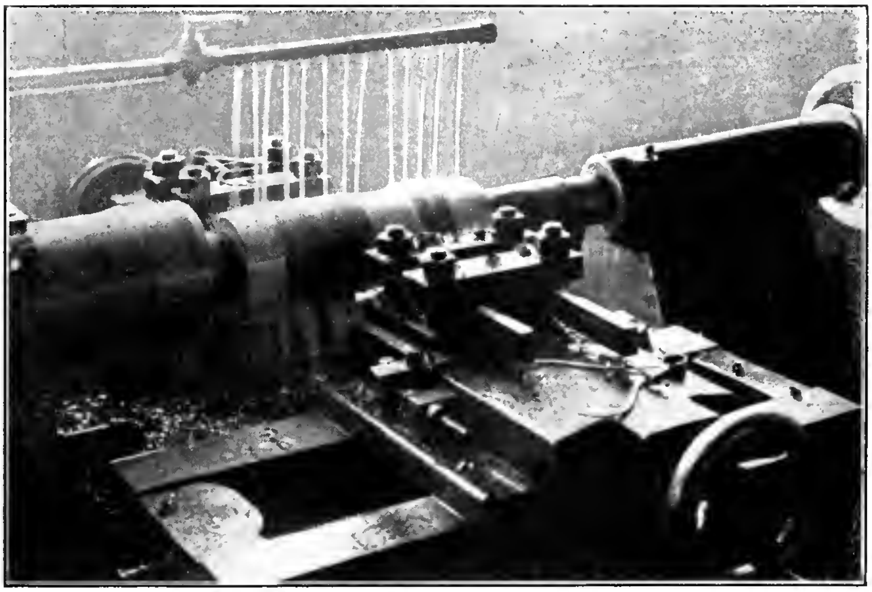


FIG. 2. ROUGH TURNING SHELL BODY.

The shell forgings are brought in at the door A, and after going through the sequence of operations are finally taken through the door B, where they are crated in readiness for shipment. The numbers refer to the various operations upon the shells, as they take their course through the shop, during the successive stages of completion.

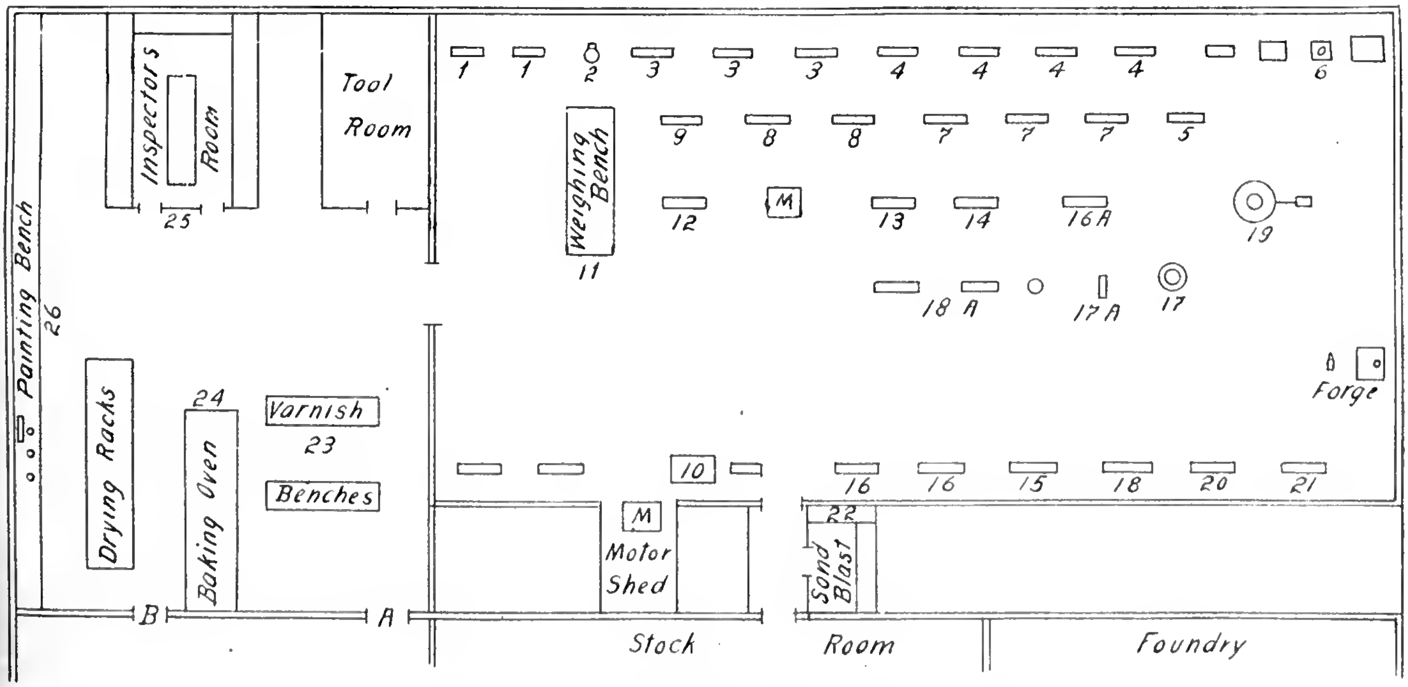


FIG. 1. SHOP PLAN, ALSO NUMBERED SEQUENCE OF OPERATIONS.

Cutting Off and Centreing

The first operation, that of cutting off the open end and roughing off the base is performed on two "Hall" cutting off machines; an average production of 125 a day of ten hours being obtained on each. After this operation the shells are placed upon a jig secured to a drill table

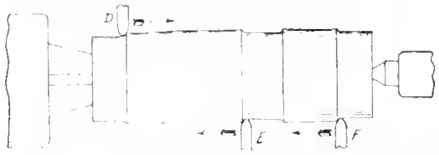


FIG. 3. TOOLING DIAGRAM, ROUGH TURNING SHELL BODY.

and the base centered with the rough bore of the forging.

Rough Turning

Rough turning the outside diameter is the third operation. This is accomplished on one Cincinnati Pulley Machine Co. lathe, with an output of 9 to 10 shells per hour, and on two J. B. Reed, 24-inch engine lathes, with an average production each of 78 per ten hours. On these last two lathes the cone pulleys have been altered to accommodate a 5-inch belt to secure increased power. (Fig. 4.)

A view of the "Cincinnati" lathe in operation is shown in Fig. 2. Three cutting tools are at work on the shell body, two at the front and one at the rear of the lathe. The front tools are fed into position, the forward tool commencing the cut about one-third of the shell length in advance of the other which starts operating on the base end of the diameter. The single tool at the rear is started at the open end of shell and travels toward the base. The setting of the tools is adjustable by the stop shown to the left of the front cross slide. By this method the rough turning is completed when the tools have travelled a fraction over one-third of the shell length.

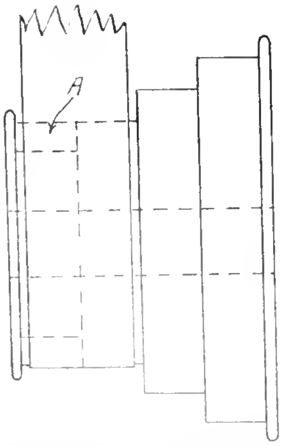


FIG. 4. CONE PULLEY EXTENSION FOR ROUGH TURNING BODY.

The position and action of the tools can be clearly seen in Fig. 3. While the two front tools E and F are advanc-

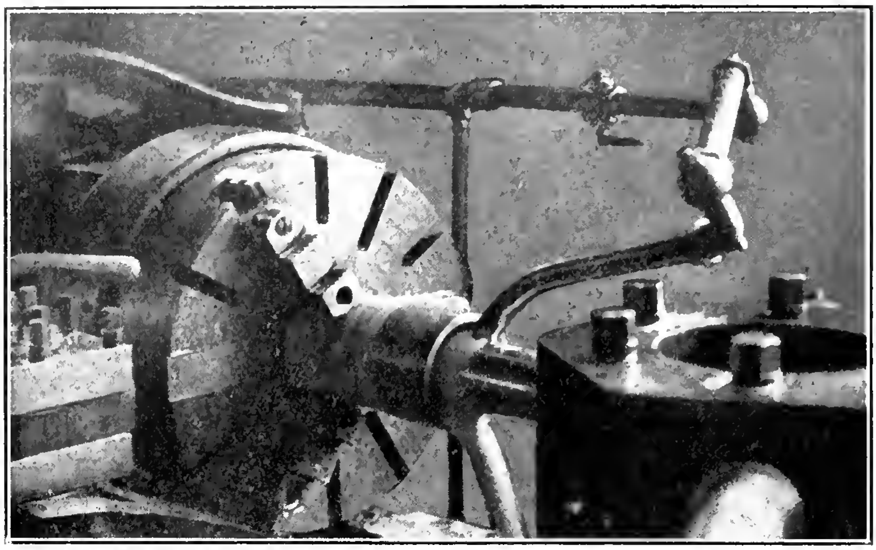


FIG. 5. BORING OPERATION ON "LIBBY" LATHE.

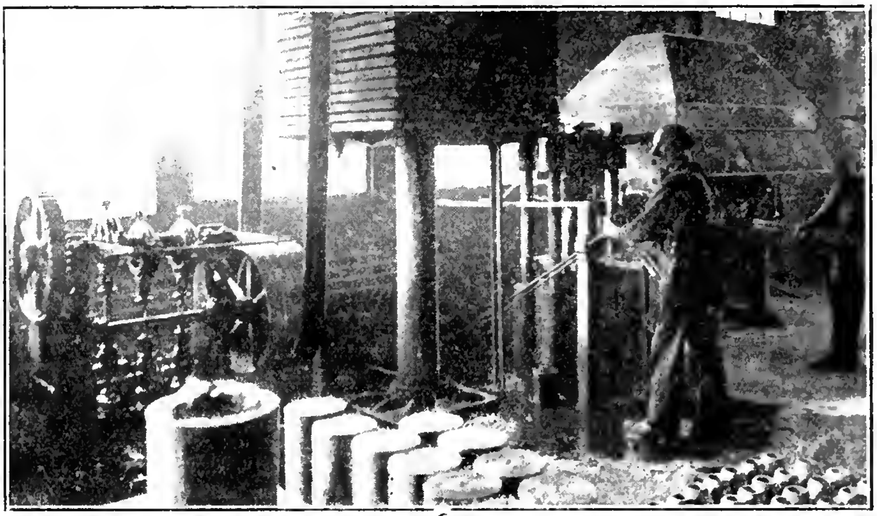


FIG. 6. SHELL NOSING EQUIPMENT.

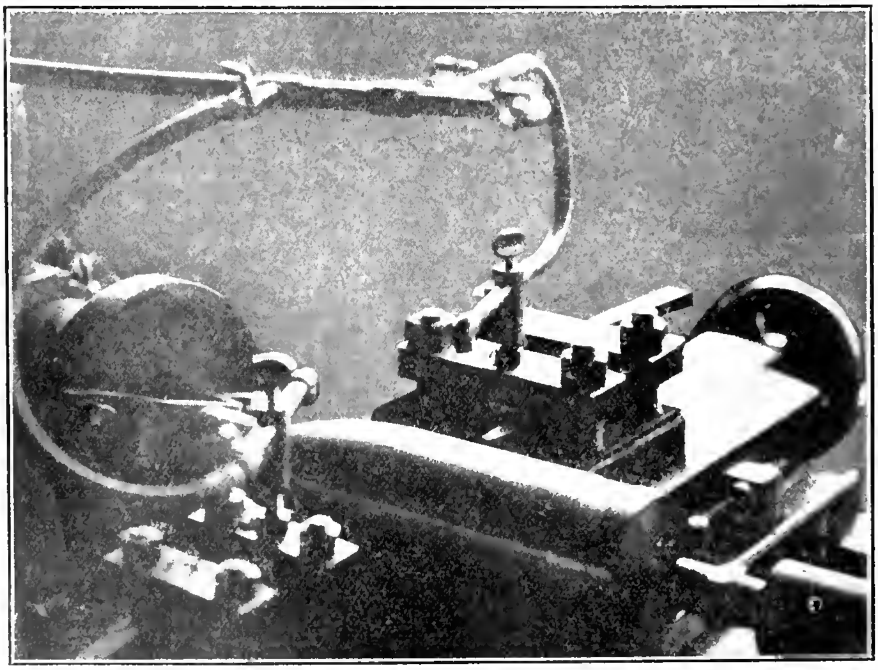


FIG. 7. ROUGH TURNING NOSE PROFILE AND BODY.

ing toward the headstock, the rear tool D is traveling in an opposite direction.

Boring

The fourth operation, boring the internal diameter and forming contour of base is done on three "Libby" turret lathes, also on one heavy duty "Le Blond" 26-inch engine lathe, fitted with special turret constructed in the shop. On the "Libby" lathes, shown operating in Fig. 5, the chuck was bored out a little larger than the diameter of the rough turned body, so as to allow the shell to be gripped in the centre, thus securing greater rigidity and increased output. The latter averages 65 in ten hours. The chamfers from the two outside diameters is put on by a tool in the cross slide while the bore is being finished. All cutters and cutting tools are made of "Firth's Speedicut" steel.

Refacing Base

After the shells have been bored, the base is faced off perfectly square, as any deviation from the vertical position might cause trouble when the mouth of the shell was being closed in. When facing off the base at this stage, 1/8 of an inch is allowed over the finished dimension to obtain a narrow flange for riveting over the base plug.

press the stock at the lower portion of the contour, and the shell when nosed may be too short. On the other hand, if the nose has not been heated sufficiently increased strain is put upon the nosing die, which may result in its breaking.

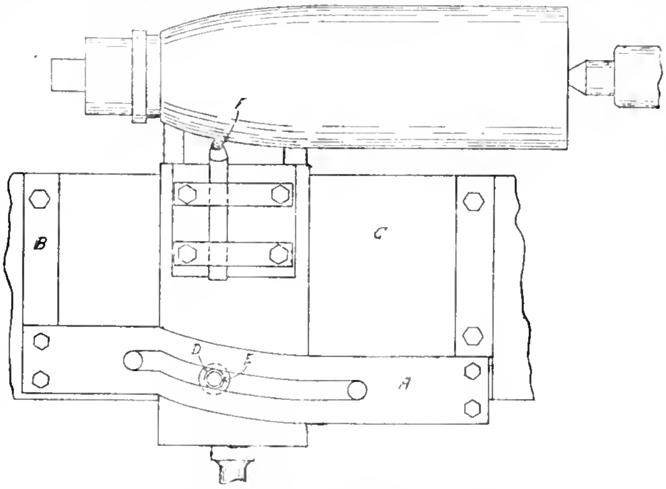


FIG. 8. PROFILE TURNING DEVICE.

The shells when heated, are placed in a "Perrin" press, equipped with a water cooled cast iron chilled die, and the nose formed. The hydraulic press derives its power from the accumulator shown, which is controlled by a three-cylinder belt driven pump installed by the W. R. Perrin Co., of Toronto.

Annealing

Following the nosing operation, the shells are placed in boxes of lime to anneal in readiness for further machining.

Roughing Outside Contour

Rough turning the outside diameter and contour of nose is the eighth operation. This is being accomplished on the Cincinnati Pulley Co. lathe shown in Fig. 7. While the tool at the rear is working on the parallel portion of the shell, the front tool is operating on the profile of the nose. The travel of the tool is governed by the run of a roller in a cam, shown in Fig. 8. The advantage of the two tools working in unison is the accomplishing of the desired result in about half the time ordinarily taken.

In Fig. 8 the brackets B which carry the cam plate A are secured to the ways of the lateral slide C. The stud E carrying the roller D is screwed into the cross slide which supports the cutting tool F. In setting the tool, care must be taken in order to have the cutting edge in line with the centre of the roller, in other words, the cutting tool should be in the same location on the shell profile, as the roller in the cam slot. It should be borne in mind that the shape of the profile produced is governed by the path of travel of the centre of the cam roller. An output of 20 shells per hour is obtained from this operation.

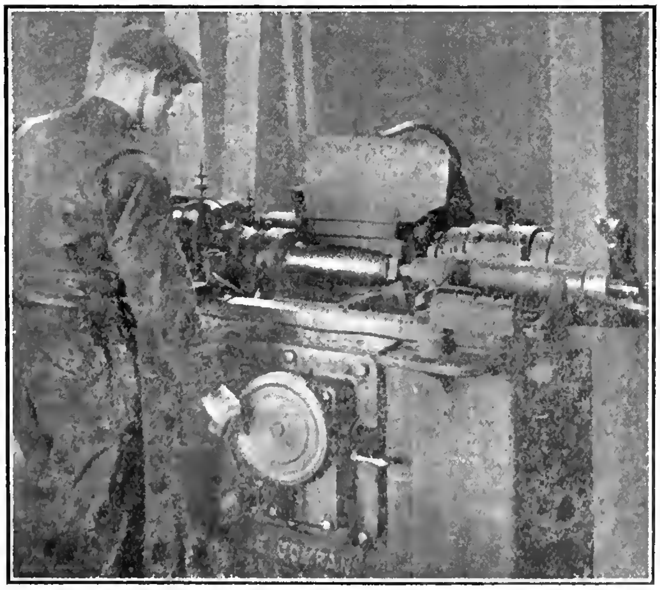


FIG. 9. SHELL BODY GRINDING

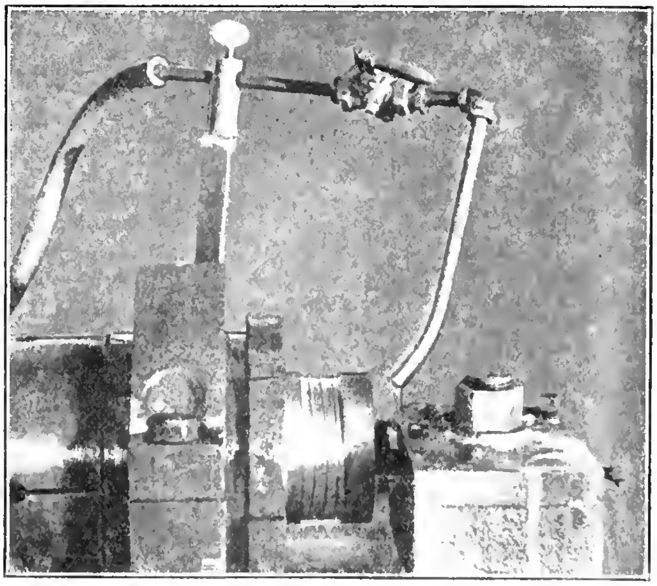


FIG. 10. ROUGHING-OUT BASE RECESS.

Heating and Nosing

The sixth operation, shown in Fig. 6 consists in nosing the shell. The Mechanical Engineering Co. furnace shown at the extreme right, heats the shells to the desired temperature, but to obtain good results much depends upon the experience and judgment of the heater. If the shells are heated too far down, the action of the closing-in process will com-

Threading the Nose

The boring, shaping and threading of the nose is the seventh operation. Two 20-inch "Walcott" engine lathes, fitted with special turrets designed and made in the shop, are used on this operation. The daily output, 24 hours, from these machines is over 400 shells.

Finish Turn and Contour

The shells now receive a finishing cut over the entire surface to bring them to the correct dimensions. This is performed on an 18-inch "Walcott" engine lathe fitted with a cam device, attached to the rear of the lathe.

Grinding

In some instances, where the shells have been found too large after the fin-

ish turning process, due to wear of tools or excessive hardness of material, it has been found necessary to grind the external surface. This is done on the "Ford-Smith" grinder equipped with

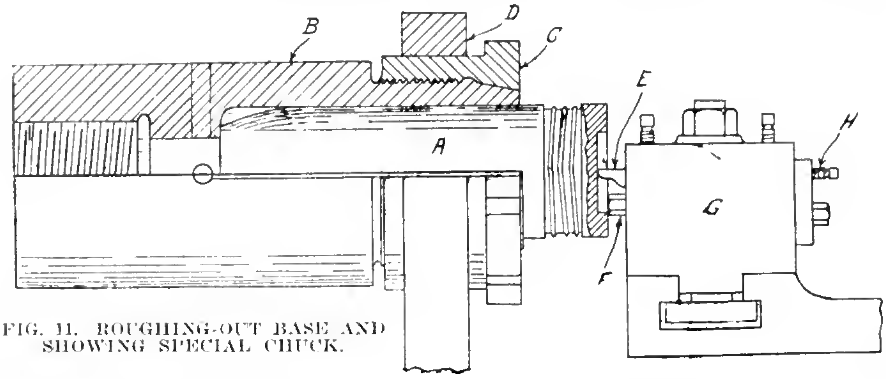


FIG. 11. ROUGHING-OUT BASE AND SHOWING SPECIAL CHUCK.

"Canadian Hart" wheels, and as shown in Fig. 9.

Weighing and Doctoring

The eleventh operation is the weighing and testing. Shells at this stage found to be overweight have the surplus stock removed from the base. This is done in what is called the doctoring lathe (12) which also takes care of other corrections that may be required at different periods during the progress through the shop.

Wave and Groove

The next operation is the roughing out of the copper band groove. Contrary to the general practice, this plant is roughing out the groove in one operation and waving and undercutting in another. These operations, although performed

FIG. 12. RIVETING-IN BASE PLATES.

separately, are done on one lathe; an extra head and attachment being placed on the bed of a 26 in. "Bertram" engine lathe equipped with a "Bertram" waving and undercutting attachment.

Thirty-two shells per hour constitute the output from this machine.

Roughing Out Base

The base is now roughed out on a "J. B. Reed" 20-in. engine lathe fitted with special drive. This is the fifteenth op-

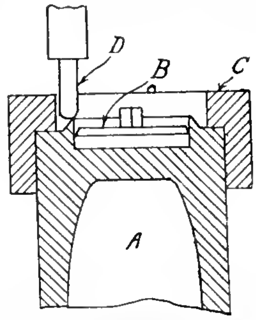


FIG. 13. SKETCH SHOWING BASE PLATE RIVETING ARRANGEMENT.

eration and is shown in Fig. 10. A sketch of the special chuck and tool arrangement is seen in Fig. 11. The shell A is held in the chuck B by closing the nose with the nut C. The rear portion of this nut is turned to fit the bore of the steady rest D. This design allows the chuck to

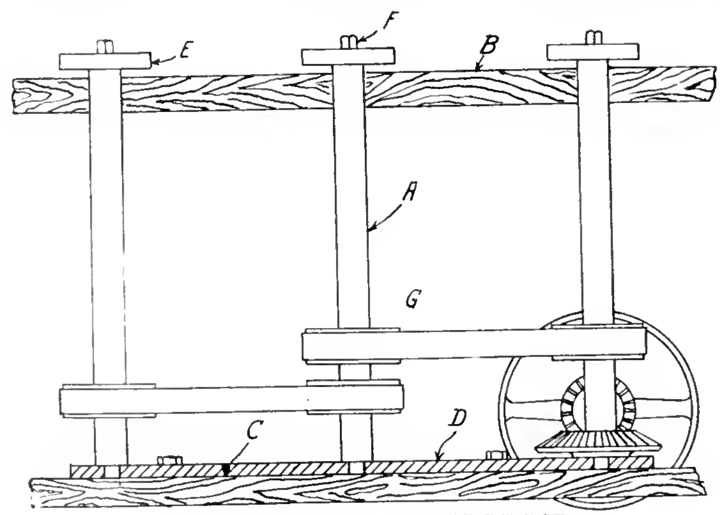


FIG. 15. SHELL PAINTING DEVICE.

be supported close to the point at which the pressure is being applied. The tool E is forced into the metal until the stop F reaches the base of the shell, while the

screw H adjusts the depth of cut and also helps to take the lateral thrust. An output of 150 to 180 shells is obtained in ten hours.

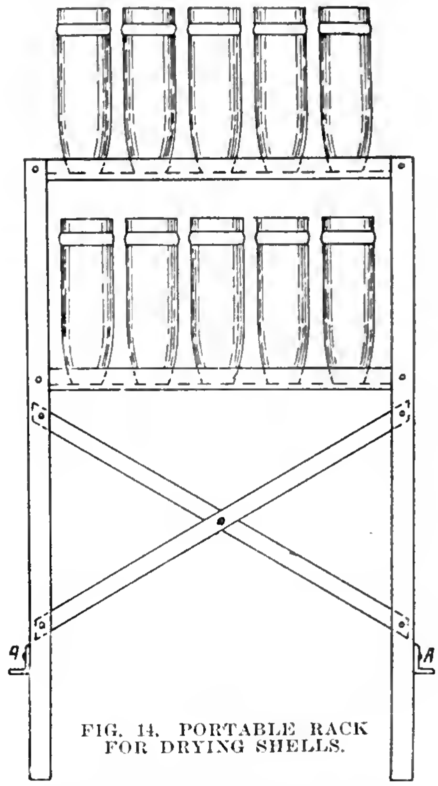


FIG. 14. PORTABLE RACK FOR DRYING SHELLS.

Finishing Base Recess

After the bases have been roughed out, the shells are taken to two "Walcott" 18-inch engine lathes, and the recess and base finished to receive the base plates, which are previously machined in a "Bardons & Oliver" turret machine.

Riveting in Base Plate

The base plates are placed in the recess and the shell held in a chuck secured to a standard on the floor, as shown in Fig. 12. A gauge C, Fig. 13, is placed over the bottom of the shell to guide the position of the hammer D, when riveting in the base plate B. When the riveting has been partly finished, the shell is re-

moved and the square on the plate cut off in a "Racine" power hack saw.

The base plate is next faced off flush and the riveting completed. The base of shell is then finished and the corner rounded.

Brass Sockets

The brass sockets are now screwed in and turned, and the small hole drilled and tapped to receive screw for time fuse. At present the sockets are being screwed in by hand with a pipe wrench, but it is contemplated to adopt some method whereby the work will be performed by the use of a power machine.

Copper Banding

The nineteenth operation, that of pressing on the copper band is done on a "Lymburner" hydraulic banding press. This is operated by a pump of the same make.

Turning the copper band is the next operation. This is done on a "Lodge & Shipley" 22-inch engine lathe, equipped with a "Lymburner" band turning attachment. The production on this machine is about 25 per hour.

A "Brown-Boggs" marking machine is used to officially stamp the base of the shells.

Sand Blast and Varnishing

The shells are next taken to the sand blast room and thoroughly cleansed of all cuttings, oil and other foreign substance. This is necessary so that the varnish will have a uniform thickness over the entire interior surface.

Following a preliminary inspection, the heated varnish is poured in and out again, after which the shells are put on a portable stand, Fig. 14, and placed in a baking oven for several hours. This stand has two shelves each containing 25 shells and near the bottom of the legs are two pieces of angle iron (A) in such a position that the "Chapman" elevating truck can be used in transferring them about the shop.

Painting

After the baking process the shells are taken to the Government room for final inspection, and from there to the painting department. The arrangement used for the latter is shown in Fig. 15. The three shafts (A) extend through the bench (B) to a bar (D) secured to a lower member of the bench (C). These shafts revolve by means of the mechanism shown. The shells are placed in the cup plates E and are revolved by the square F which fits into the hole in the socket plug. They are finally put up in boxes, two shells to each box, ready for shipping.

THE AUTOMATIC MACHINE

THE automatic machine often offers a reduction in labor cost that more than offsets the increase in overhead charges which it incurs. Conditions of the labor market are sometimes such that the automatic is used even where the total cost of its product is known to be somewhat higher. It is undoubtedly true that there are many cases of hand turret lathes being used when automatics would be more economical, and there are certainly a great many cases when the reverse is also true. The merits of any particular case must be decided by the exercise of unusually good judgment; or, better, by a study of costs which takes the overhead charges into account as well as the labor cost.

In this connection it may be noted that the manufacturing cost of high-grade machinery is usually made up of about one-third direct labor, one-third material, and the other third overhead charges of various kinds. Of these three items, that of material is not greatly affected by the style of machine used. In large work the hand machine tends to reduce the overhead charge, while the automatic machine tends to reduce the direct labor change.

Automatics and Quantity Production

If there is demand enough for an article to support large establishments for its manufacture, and if there are no patent or other restrictions to keep its manufacture in the hands of men of limited ability, the normal tendency is toward quantity manufacture. The cheapening of production by using automatic machinery on large lots is an important factor in this tendency.

If the article of manufacture can be standardized, so that the design changes little from year to year, the advantages of large scale manufacture are still more apparent. Machines can be kept on one piece continuously day and night, if necessary, until worn out. Operators can be trained to great skill, not only in getting large output for the comparatively few pieces or operations in their repertoire, but in getting a high grade of workmanship as well, where that is necessary. Special machines, each built for one operation only on a single piece of work, can be profitably used.

Such a manufacturing system also has its disadvantages. The most obvious of these are the necessity for keeping the product free from change as far as possible; and, also, the monotonous character of the work from the operator's standpoint. Of course, no industry is fit for large scale, intensive manufacture until the product is fairly well standardized; or at least until the particular design selected for manufacture is such that it will suit a large percentage of possible customers. To increase the field of customers, such an establishment is in a position to offer attractive low prices for its standardized output, in place of the frequent novelties and special features offered by smaller manufacturers.

There is also something to be said for such an establishment from the standpoint of the workman. An immense amount of ability, of the highest order, must go into its management; and its organization furnishes opportunities for many such men. On the other hand, for workmen of faithfulness and dexterity, but small originality, it can and ought to furnish work at higher wages than they could obtain in any other employment. Many skilled workmen, as well, find these high wages a compensation for the monotony of continuous work on one piece.

From a paper presented at the International Engineering Congress, San Francisco, by Ralph E. Flanders, manager, the Jones & Lamson Machine Co., Springfield, Vt.

LUBRICATING CHAINS

SOMETIMES lubricating chains are employed instead of rings for bearings, the idea being that the chains touch the shaft through a longer arc, and, therefore, are supposed to be kept in motion more surely than plain rings. It must be remembered, however, that the part of the chain immersed in the oil bath offers greater resistance than a plain ring, so that in actual practice there is not much difference between the working of chains and the working of rings. At high speeds there is the disadvantage with chains that the links, when passing through the oil, churn it up. This makes it more difficult to prevent leakage of oil from the bearings.

Satisfactory lubrication of dynamo bearings, i.e., cool running and inappreciable wear, is very important. If wear takes place this means that the rotor is lowered, and the magnets will then exert a pull in a downward direction, which further increases the pressure and accordingly the wear of the bearings.

EVERY applicant for a position undergoes an appraisal based on outward appearances. This initial valuation may or may not be correct, but it counts for a great deal with most employers, for the average employer flatters himself that he is an excellent judge of human nature at sight. First he looks at the features, then at the garments of the man, or he takes in both at a sweep. Instantly he classifies the applicant, and, since he has made this tentative classification, is slow to change it. Engineering and Contracting.

Large Shells: Production Problems and Possibilities--III.

By C. T. D.

In preparing to undertake the production of large shells up to 9.2 in. dia., manufacturers will encounter problems of a nature altogether different from those connected with 18 pdr. shells. Automatic machinery will not be so applicable to the larger sizes, and productive ability will centre largely on such points as sequence of operations, tooling methods, etc.

THE operations listed in group B are those which would be actually required if group A has been performed in the order shown. If the nose has been centred only and not drilled through, it may now be drilled very close to the finished size, leaving only sufficient for a light cut with the boring bar in operation B 3.

One point in favor of centering the nose only and not drilling through in group A, is that it allows the shell to be positioned by the point of the arbor which acts directly against the inside surface of the nose, whereas if the hole be drilled first, the end of the arbor has to be formed of three points making contact on a circle larger than the hole. This point of contact is situated on the tapering part of the nose, and any slight variations in the profile, or irregularities in the surface would cause a greater change in the position of the shell due to the sloping wall on which the arbor made contact.

Such change in position might vary considerably with roughly made forgings and cause occasional trouble with thin walls which can be avoided if the shell be positioned with the point of the arbor against the end of the nose. The possible variation in position would now be directly proportional to the irregularities on a small surface which could be inspected both by eye and hand much more effectively than the sloping portion of the nose; the actual point of contact being known, whereas the probable points of contact on the three-point arbor could only be guessed at.

Should it happen, therefore, that operation B1 calls for drilling as scheduled, this can be done quite satisfactorily in any vertical drilling machine of suitable size. In performing this operation, the internal supporting arbor is dispensed with, and the shell placed upright on the base which has just been trimmed. If the drilling be done with ordinary care, the hole will be fairly concentric with the outside surface of the shell, and will run practically true when the shell is chucked as per operation B2, see Fig. 5.

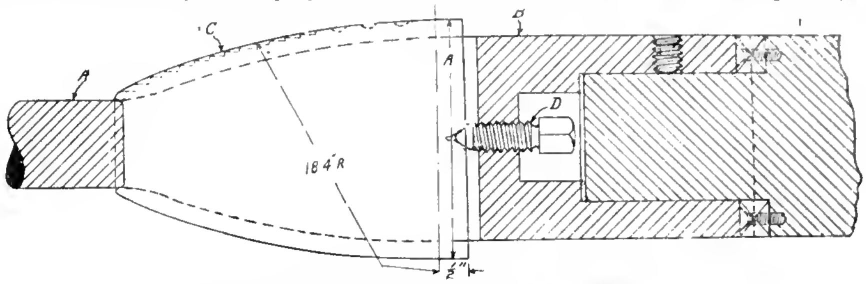


FIG. 6. DETACHABLE BORING HEAD WITH FORMED CUTTER.

The tooling outfit as shown here can be used for every operation which it is advisable to do at this chucking of the shell. The forging shown is the one for the 8 in. shell, and as many makers will be utilizing existing machines, the belt power will probably not be sufficient for pulling simultaneously all the cuts which it is possible to arrange. The work, therefore, is arranged more in accordance with such methods as obtain in general machine shop practice.

The boring bars are fitted to a simple form of revolving tool box or turret, which should be accurately located to line up the bars with the spindle, and securely fastened in place. A quick acting and rigid clamping device is essential.

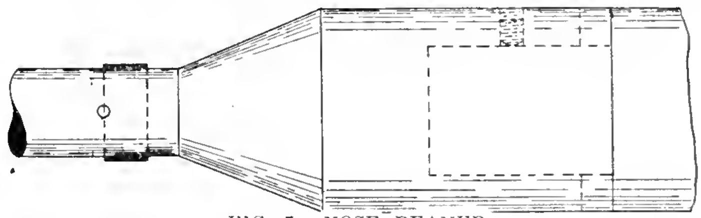


FIG. 7. NOSE REAMER.

The boring bar shown in operation is made as large as possible, while leaving sufficient space for cuttings to pass freely. One slot only is shown, and a set of interchangeable double edge cutters is used. These cutters are checked in on the back and held in place by a wedge.

After roughing and finishing the parallel bore, the turret is reversed and the forming cutter, sometimes termed arch, acorn, or nose reamer, is brought into action. Two cutters of this type are necessary, the roughing ones have serrated edges to facilitate breaking through the scale quickly, and the finisher being

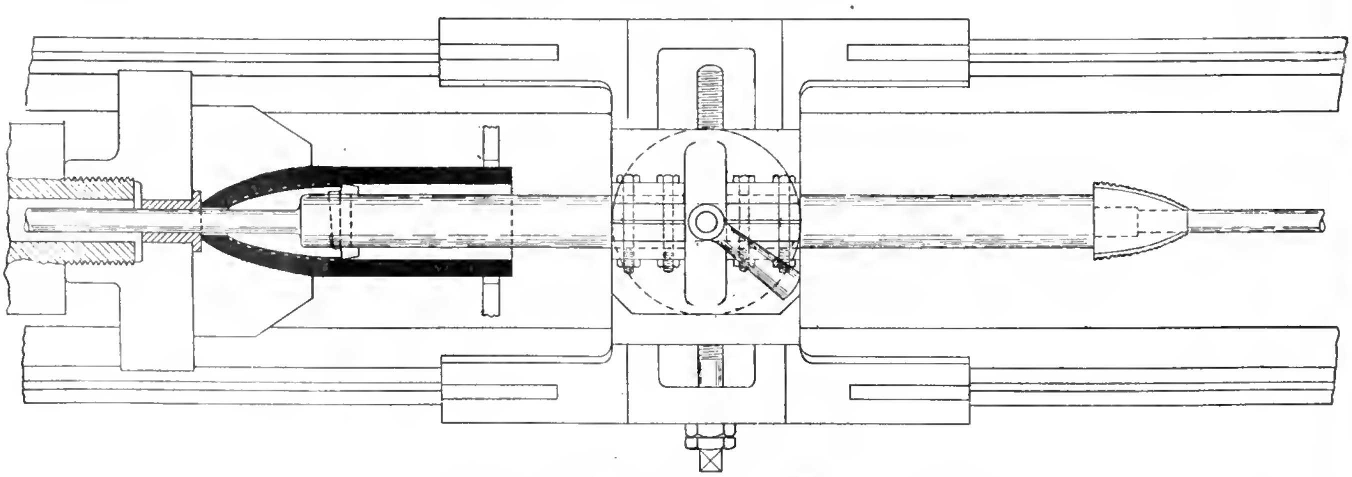


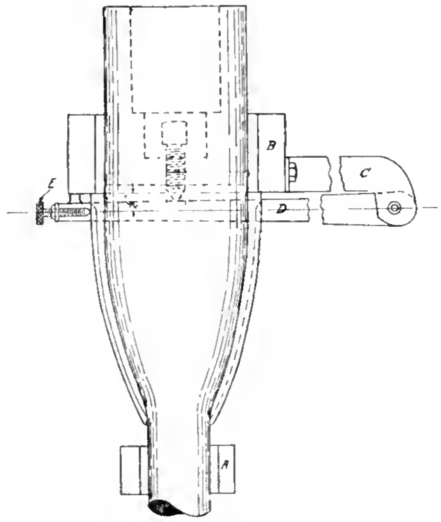
FIG. 5. DIAGRAM ILLUSTRATING OPERATIONS B3, B4, AND B5.

ground exactly to the required curve.

Where tool room facilities are available, and the cutters can be properly hardened, the method of construction preferred may be that in which the cutter is made from solid stock, and grooved like a reamer, with any desired number of cutting edges. First-class workmanship is necessary for the production of this type of cutter, and it must be kept in good condition, and used carefully if costly renewals are to be avoided. It is not quite suited for use with a pilot which is somewhat against its use in ordinary machines. It is used, however, on some special machines having very rigid boring bars.

A type of flat blade cutter is shown in Fig. 6, which has the merit of simplicity of construction, and cheapness of renewal, and permits the use of a pilot if desired. The pilot A, and body B, are made in one piece, a slot being cut to receive cutter C, which is checked at the nose to position it at the pilot end of the slot. The base end is centered to receive the point of set screw D, which is made as large as possible. This set screw is located at the bottom of hole which fits on the reduced point of the bar in the turret. Two driving keys are fitted on the bar and drive the cutter through corresponding slots as shown. A hollow set screw is provided in the cutter body to ensure its withdrawal from the shell.

In making roughing blades for this type of cutter it is satisfactory to file the bottom clearance by hand, but the shape of the serrations or gashes on the cutting edge should receive some consideration so that the height of the ridges left for removal by the finishing cutter is fairly uniform, and excessive wear is not localized on any particular part of the finishing cutter. Reference to Fig. 6 shows a method of determining the serrations. Diameter A is made cylindrical



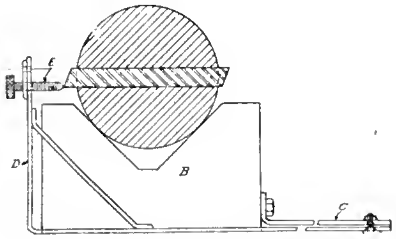


FIG. 8. RADIUS GAUGE FOR INDICATING PROPER CLEARANCE ON FORMED CUTTER.

and three to five thousandths of an inch smaller than the finished parallel bore, so as to act as a pilot on the rear end of the cutter and prevent excessive side strain on the set screw.

The flatter portion of the curve immediately forward of diameter A, may be gashed with a small round file, while further forward the gashes take the shape of saw teeth so proportioned that the short side of the tooth is at right angles to the direction of feed. Suitable clearance must be given to this edge and care must be taken to make the root of the tooth nearer the centre of the bar than the point is. By doing this, the teeth cut with the small edge only and with the greatest efficiency. The dotted lines in Fig. 6 indicate the form of the serrations on both edges of the roughing cutter.

The finishing cutter of course is made exactly to profile called for by drawing. Attention may well be given to the method of forming the bottom clearance on this cutter so that considerable thickness of the blade can be ground away in sharpening without altering the accuracy of the curve. If the blade be mounted in a bar, and given clearance in the ordinary manner with a relieving attachment in a lathe the clearance on the large diameter will be greater than at the point or nose. This is because the plane in which the relieving tool moves is always at right angles to the bar, consequently as the curve of the blade approaches the bar, it is no longer at right angles to the plane of the relieving tools. If the curve of the blade were such that it turned round square across the bar, so as to cut like an ordinary boring cutter, the relieving tool would not give it any clearance at all.

To form this clearance by machinery would call for more complicated mechanism than is desirable. It can easily be done by hand and checked up by a gauge as shown in Fig. 8. The machining arbor is supported on suitable vee blocks A and B. Attached to the larger block B, is an extension C, which supports the radius arm D. This radius arm is made equal in length to the radius called for on the finished shell, and the point on which it swings is coincident with the centre from which that radius is struck. The end of the arm is turned up towards the curved edge of the cutter and has two holes tapped level with the upper and lower edges of the cutter. An indicating screw E, adjusted in either of the holes will show any deviation from the true curve, and the desired amount of clearance can be given by hand and checked up accurately by using the indicating screw in the upper hole. A suitable centre should be provided in the hinge pin of the radius arm so as to set the indicating screw accurately.

As shown in Fig. 5 the nose of the shell is butted up against a gauge stop on the chuck so that boring cuts can be made to certain definite depths to be determined by experiment. The bushing which is used for this purpose can be made with a slight counterbore to clear the final reaming cutter which passes through the nose to size the hole for tapping. This reamer is used on the second

OPERATION TABLE.

Operation Number	Description.
	Group A.
1	Grind off scale on point, forming small flat.
2	Place on expanding arbor which locates shell from inside, and positions it lengthwise from inside of nose.
3	Face-off nose of shell to necessary thickness.
4	Drill centre with drill in tail stock, remove drill and adjust dead centre.
5	Rough turn body, commencing at nose and traveling to point where open end of shell is cut on.
6	Cut off open end of shell to length measured from nose.
	Group B.
1	Drill hole in nose, leaving stock for final boring.
2	Chuck by nose with outer end in steady. Nose of shell in contact with gauge stop on chuck.
3	Bore parallel portion with roughing and finishing cutters.
4	Form interior of nose or arch.
5	Finish overall length and counterbore. Tap base.
	Group C.
1	Tap nose.
2	Insert threaded driving plug centre in base, and common threaded plug centre in nose.
3	Finish outside to size and shape.
4	Machine and undercut groove. Wave ribs.
	Group D.
1	Press on driving band.
2	Machine driving band.
	Group E.
1	Remove service plugs and assemble base plug and nose bushing.
2	Face off base and finish bushing.
3	Enamel interior and bake.

bar and is interchangeable with the forming cutters just described.

The counterbore into which the flange of the base plug fits is formed by a cutter which is located in a suitable position on either of the bars. By making this cutter of suitable shape it faces off the end to accurate overall length at the same time, after which the shell is ready for tapping.

The thread which is formed in the base of the shell to receive the base plug must be perfect so far as finish is concerned, the actual limits of variation in size being easily maintained, and not presenting such a problem as the production of perfect pitch, circularity, and smoothness of surface. The use of a thread milling machine followed by a tap, preferably collapsing, offers the most reliable and accurate method of threading. While tap makers may produce taps suitable for these large diameters, the necessity of terminating the thread close to a given point, throws undue work on the leading teeth of the dies.

Attempts to produce the work at the necessary rate on an engine lathe would spoil an undesirable percentage of the work, unless first-class skilled labor and accurate machines were used. It would, therefore, seem wise to make haste slowly and surely regarding this one operation. At all events it will be found best to do this work in a specially equipped machine with reliable help. The completion of this operation finishes group B.

INDICATIONS OF A STEEL FAMINE

INDICATIONS are not wanting that if there is a continuance of the demand for steel for the manufacture of munitions throughout another year or so there will be a general steel famine—a famine which will be severely felt in this country. The most outstanding indication of this is to be found in the action of the United States Steel Corporation, which was referred to in these columns recently. The situation has shown no improvement since, but rather the contrary; the big American company continues its attitude, which is that prices have been withdrawn on all export business.

Canadian officials of the company have little to say further than that the demand for steel has been such that until the future is more clearly defined no more foreign orders will be accepted. It is not so much an indication that Canada may be indefinitely cut off from her American supplies, but the fact that U. S. Steel is forced to take such action is a startling revelation of the position of the whole market.

Munitions Demand the Chief Cause

At the present time the chief feature of the steel trade is the munitions business, especially in Canada. In the United States, as in this country, there has been heavy consumption for shells, and, on the other side of the line, this has been followed by a heavy domestic demand, in which the railroads have played a prominent part. This has had the effect of piling up orders for many months in advance .

The situation as regards munitions in Canada does not appear to be directly affected by the cutting off of American steel. In other words, supplies of steel for munitions manufacture have been booked months ahead by the Shell Committee. So far as munitions are concerned, then, the question is one largely of the future, but it undoubtedly creates a problem in connection with any orders that the Shell Committee may have in hand for which they have not booked steel and for orders to be placed in the future.

The Domestic Situation

The domestic situation as regards steel products is more directly affected. It is doubtful if such an upheaval has ever occurred in the metal trades in this country as that brought about by the withdrawal of American prices. On wire, sheets, boiler plates, tubes, and many other lines, not to mention the higher manufactures of the metal, there are indications that the famine may not be long delayed if there is no relief offered—and there appears to be none in sight. Metal merchants state that they are not only told that there are no quotations, but the intimation is that their business is not wanted and propositions do not receive consideration.

This is a particularly difficult problem with the great bulk of Canadian steel being devoted to the manufacture of munitions, because we have become more dependent upon the American producers for the special products. The result is that, with the prospects of a future shortage, prices are being rapidly advanced on the many lines directly affected, and the outlook is for rising prices until such time as there is some definite assurance of supplies. If there should at this time arise a domestic movement similar to that in the United States the famine would almost immediately become an actual fact.—Financial Post.

New Zealand Scheelite.—A New Zealand lady has offered the Government the gift of a deposit of scheelite—an ore yielding tungsten, used in hardening of steel—containing 30,000 tons, now worth £631 per ton. The deposit, discovered in the Marlborough district of New Zealand several years ago, consists of three reefs, over which she holds the mineral rights. The offer is conditional upon all moneys received being paid over to wounded soldiers.

WHAT ARE MONITORS?

THE bombardments of the Belgian coast, carried out by a squadron under the command of Admiral Bacon, claim our attention.

To commence with, General French has let us into the secret of the important naval post to which Admiral Bacon was appointed. This officer will be remembered because of his association with the submarine service in its early stages, as a member of the committee which approved of the Dreadnought design, and as the first captain of the Dreadnought. When war broke out, Admiral Bacon was connected with the Coventry Ordnance Works, and some criticism was passed on the appointment of a retired officer in preference to the rear-admirals still on the active list.

Some years ago the Germans carried out a series of experiments with the view of testing the efficacy of concealed shore batteries against ironclads, and the conclusion was reached that no country would risk her fighting ships in an attack on a defended coast.

After the first surprise attack on the Belgian coast by Admiral Hood's squadron, the enemy immediately studded the coast with batteries. No doubt they hoped that this would act as a deterrent to further attempts by our ships, but they had reckoned without the skill of our naval authorities.

Vessel Features

The outstanding features of these vessels, which as a class are named after Ericsson's first "monitor," are shallow draught, small freeboard, low speed, heavy armament, and fairly efficient protection. The shallow draught renders them capable of working in shallow water, and this is an advantage in two ways: it permits of their working close inshore and in waters too shallow for a submarine to manoeuvre in without running suicidal risks. The shallow draught also means a small underwater target, which compensates for the lack of defensive qualities incidental to the slow speed.

The low freeboard makes these vessels a very small target for the land gunners. Briefly, the monitor represents the maximum hitting power carried in the smallest possible space, big offensive qualities in a small target.

These little vessels have overcome the elaborate plans of the enemy for the defence of the coast. They are the best possible reply to the enemy's move, and they show that, in spite of all that is urged against our administrators, we do possess men capable of finding the flaw in the enemy's plans, and resourceful enough to develop the means of profiting by their discovery.—Liverpool Journal of Commerce.

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Machine, Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

FLAT SURFACE GRINDING MACHINE FOR SHELL WORK

THE remarkable efficiency shown by disc grinders on shell work has led to their rapid adoption by numerous munitions factories in all parts of the world. As a result of this widespread use of their machines, Charles H. Besly & Co., 120F North Clinton Street, Chicago, U.S.A., have been enabled to incorporate many new and efficient features which make this machine invaluable to makers of shells up to 4.72 in., or 120 mm. diameter.

The Besly shell grinder is illustrated in Fig. 1, with water hoods and piping removed to show construction. This shows the machine equipped with work-holders for removing stub ends left for centres on 3-in. shrapnel shells. Stub ends, 5/8 in. diameter by 3/8 in. long, are removed, and end of shell finished flat, smooth and square at the rate of 100 shells per hour per operator. The geared lever feed table on the grinder carries an adjustable micrometer stop screw, bringing the work accurately to length (if required) and duplicating.

The grinder spindle is driven by a 7-in. belt running 4,000 feet per minute, so ample driving power is provided. The grinding is done by vitrified ring wheels held in pressed steel chuck. It should be noted that as the grinding wheel wears away, it may be set out in the chuck as required. The ring wheels are 16 in. diameter, 4 in. deep when new, and may be worn down to 1 in. in depth before being discarded.

Fig. 2 shows the Besly shell grinder equipped with rotary chucks for accurately finishing the inner face of base plates or gas plugs for high explosive shells. The action of the grinding wheel rotates the work while grinding, producing work of extreme accuracy in flatness and angularity. Many munitions manufacturers have had trouble trying to produce base plates or gas plugs with the inner face flat and accurately at right angles to the axis of the thread on the plug. This plug is a difficult thing to hold rigidly enough to thread accurately and face flat and square. The Besly shell grinder with rotary chucks, as illustrated in Fig. 2, overcomes this difficulty, because in the facing operation the plug is chucked from the threads. When required, this face may be ground with a camber of .002 in. to insure contact all over.

This special rotary chuck is also used with unthreaded, beveled jaws for grinding the unthreaded beveled base plates or gas plugs, now being used by a great many manufacturers of high explosive shells.

The time for this grinding operation is 60 to 80 gas plugs per hour, per operator, depending on the amount of stock to be removed.

These grinders are also supplied with work-holders for facing the end of 4.5 in. and smaller high explosive shells after base plate or gas plug has been inserted in shell, and the square projection on base plate removed by sawing, twisting or grinding. Where gas plugs are threaded, the square projections are usually twisted off after the plugs are screwed home in the base of shell. Where the unthreaded, beveled gas plugs are used, this square projection is usually sawed off in power saw, although it is entirely practical to remove same by grinding.

After the square is removed, there is up to 1/16 in. of stock to be removed from the rear face of the gas plug (3 3/8 in. diameter) to bring same flush with base of shell. This grinding is accomplished on the shell grinder at the rate of 15 to 40 shells per hour, per operator, depending upon the amount of stock to be removed.

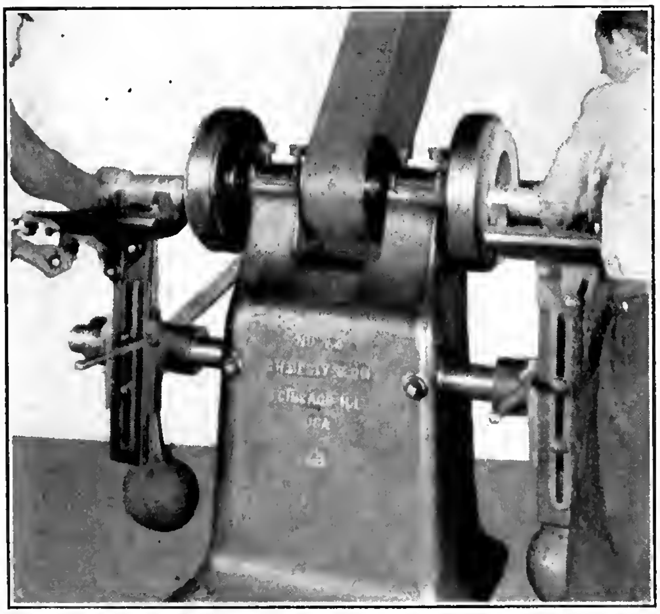


FIG. 1. GRINDER WITH WATER HOODS AND PIPING REMOVED.

FIG. 2. GRINDER SHOWN EQUIPPED WITH ROTARY CHUCKS AND HOODS.

In connection with the water hoods, there are a pump and settling tank of 40-gallon capacity, with suitable settling compartments to extract the grindings from the cooling compound.

An exclusive feature on this machine is the provision of a geared lever feed on the table, providing a leverage of 26 to 1, making it easy for the operator to force the grinder to the limit of its capacity.

All wearing parts are renewable and adjustable for wear. The machine weighs over 3,000 pounds. The spindle is 2 in. diameter, and has a total bearing length of 18 in., the end thrust being taken on hardened and ground thrust bearings.

Papers Read at the Recent Foundrymen's Convention

Selected from the more important subjects presented for discussion before the Annual Convention of the American Foundrymen's Association and the American Institute of Metals at Atlantic City, N.J., during September, 1915. The papers cover a wide field of foundry and allied activity, the nature of the results and the completeness of the reports making them of particular interest to all who desire to keep in touch with metallurgical progress.

ESSENTIAL ELEMENTS OF SHERARDIZING*

By S. Trood

BEFORE going into the description of sherardizing, it is well to mention something about zinc.

Zinc is a peculiar metal of pronounced characteristics. It is relatively low in malleability, ductility, tenacity and fusibility when compared with other common metals. Zinc has a melting point of 419 deg. C. and under atmospheric pressure a boiling point of 918 deg. C. While under vacuum, the boiling point is reduced to 548 deg. C. On the basis of silver at 100, zinc has an electrical conductivity of 29, a heat conductivity of 36, and is practically non-corrosive in the atmosphere, a thin protecting coating of carbonate of zinc forming upon it. Zinc is one of the highest electropositive metals, having a potential of plus 0.493 volts.

Although many of the common metals date their discovery to prehistoric times, yet zinc was unknown as a metal until discovered by Paracelus in 1520. Previous to this, however, the action of zinc ores upon copper under action of heat was well known. Henchel in 1271 published an account of his discovery that metals when heated in calamine changed their properties, and in 1740, John Champion, of Bristol, England, obtained a patent for the process. Two of the processes of smelting zinc to-day date back to 1805 for the Belgian process and 1897 for the Sicilian process. In the United States, the Government was the first to use zinc, making the standard of weight and measure from brass.

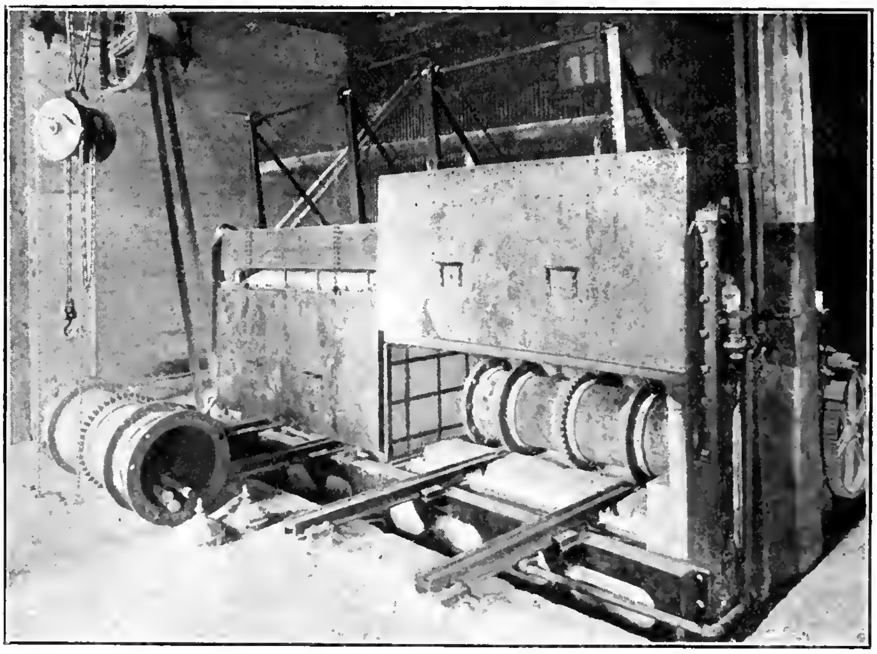
It has only been within the last century that zinc has been used commercially as a protection against corrosion, and as a proof that the tendency of using zinc is toward the conservation of natural resources, it will be seen that by comparing the production of zinc and steel for the last four decades, the large increase in each has been running parallel for the corresponding years.

Process Features

In general, the process of sherardizing consists in treating in zinc dust, articles which it is desired to rust-proof. The zinc dust consists mainly of finely powdered metallic zinc with zinc oxide. After packing in a suitable container, the whole is heated for a certain period of time, cooled and articles then removed from the zinc dust. From everyday practice, we note that if we desire uniform results in a manufacturing proposition, we must have uniformly arranged details. So far as the sherardizing is concerned, the uniformity of each step in the process is very vital and necessary for success. In trying to explain what happens in the drum, the necessity of uniformity will explain itself.

Zinc dust is in a very finely divided state, and each particle covered with zinc oxide. In this condition, zinc could be heated above the melting point without fear of liquefying the mass, and because the zinc oxide is quite high fire-resisting material of inert nature, it prevents small particles of heated zinc uniting together and creating a solid liquid mass. It is also a well-established fact that under these conditions solid matter can be made to sublime; in other words, a solid can be brought to a vapor, overstepping the liquid form.

According to authorities, vapor tension for a small particle is greater than vapor tension for a big body, due to the difference in the ratio between surface and volume. Armstrong, Thompson, and other scientists have shown that a gas emanated from a solid has an electrical charge. From this, it follows that the microscopically small atmospheres of zinc vapor surrounding these dust particles are charged electrically, and due to their minute size, they may be considered to have all the properties of ions. Iron being heated, also emanates gases which produce ionic charges. Iron and zinc have different electrical potentials, and, therefore, the ionic charges of zinc and iron vapors will have a different potential. If this is a fact, then discharges must occur. Ionic discharges precipitate solids from gases, and in our case zinc and traces of iron would be precipitated.



TWO COMPARTMENT SHERARDISING FURNACE, TAKING 18 IN. X 60 IN. DRUM, INSTALLED IN PLANT OF CHAMBERS, LTD., TORONTO. THE FURNACE IS ARRANGED TO HANDLE MATERIAL UP TO 11 FT. 6 IN. LONG.

Atmospheric Effect

Assuming once more that the theory is correct, the atmospheric pressure will have considerable effect on the process, as the vapor tension of gases will vary with the pressure, and the gases will be more readily emanated in vacuum. If we make use of a considerable vacuum, for instance, 28 ins. of mercury, the ionic discharge would be very effective. To prove this, I created a vacuum in a small sherardizing drum. In this case, the precipitation of zinc and iron took place at a much lower temperature and in considerably shorter time. Results were produced in ten minutes in a vacuum, which would require six hours at the same temperature, but under atmospheric pressure.

*From a paper read at the American Institute of Metals Convention, held in Atlantic City, N.J.

It is a well known fact that the electric potential is higher for pure gas than for a mixture of gases. Therefore it is quite advantageous to have pure zinc dust and the iron in as pure a state as possible. As before stated, zinc is one of the metals which has the lowest difference in temperature between melting and boiling point, and this difference is quite low under vacuum. This is another proof that, with pure zinc dust under vacuum, the vapors will be created much more readily, ionically charged and precipitate the solids upon the surface.

Zinc Dust and Heat Factors

From the above, we can draw the conclusion that uniformity of zinc dust is a very important factor. Uniformity of heat, however, is of just the same importance, since the higher the temperature, the greater is the emanation of gases and, therefore, precipitation of solids. This may be seen on sherardized metal in the typical "color lines."

With every increase of temperature, with all conditions the same, the precipitation of solids increases and creates a deposit of a different character, and the same is true with a decrease in temperature, which retards the process and creates a less dense coating. These differences, which produce the stratified appearance or lines of color, are quite distinct under a microscope and may explain the very fine microscopic checks. That the quality of iron to be sherardized has a similar effect on the process can also be readily understood, as emanation of gases from iron depends greatly upon its composition. Particles imbedded or stuck on the surface may also change the potential.

The last great factor in the process is time. It is self-evident that the effect of precipitation will continue so long as the conditions are favorable to create the effect. To repeat:—1st, composition and quality of the surface of the iron; 2nd, composition and uniformity of zinc dust; 3rd, proper uniform temperature; 4th, time, are the most essential factors in the process of sherardizing. The practical side of sherardizing depends solely upon the four factors just mentioned. Sherardizing is mostly applied to steel and iron in all its forms. Articles which could not be heated, should not be sherardized. All material should be examined and rejected if it is scaly, covered with silica or any other impurities.

Preparing Surfaces for Sherardizing

The best method of removing the impurities—in other words, preparing the surfaces to be sherardized—is shot air blasting. This method is fundamentally the best, because in sand blasting particles of sand or silica penetrate the pores of the iron and are very disadvantageous. Pickling requires great skill and must be done very carefully, as very often sulphates or phosphates are created on the surface, and if washed in alkalies, very often go into colloidal state. In other words, they become insoluble and very hard to remove. Another disadvantage of pickling is that the traces of salts, alkalies or acids when heated, may produce a retarding result so far as the ionic charges are concerned.

There are different zinc dusts on the market and those coming within the following limits would be the most advantageous:

Zinc between 85% and 90%.
Zinc oxide between 8% and 10%.
Lead between 1% and 1.5%.
Other impurities between .5% and 1%.

The three most important elements to be kept near the above percentages are:

Zinc which ought not to be below 85%.
Zinc oxide which ought not to be below 8%.
Lead which ought to be kept down to about 1.25%.

Although good sherardizing may be obtained if some variations from the above exist, the best results will be obtained if the percentages are kept within these limits. Lead must be kept down to the least practical amount, as experiments have shown that, when its percentage runs too high, lumpy deposits will appear on the sherardized plain surface and will also clog threads.

Free iron must be separated from the zinc dust as much as practice will allow, and in a well-established plant it is being done at least once in four weeks. This will remove surplus small particles of iron; which are liable to become lodged between the jaws or cotter pins, etc., and thus cause trouble in assembly. By cleaning the dust this way, the mechanical incorporation of small percentages of iron dust in the coating is also prevented. The weekly analysis of the working dust should show the iron content.

It was mentioned above that the size of particle has an effect on a vapor tension. Therefore, zinc dust must be kept uniform in size. When the zinc becomes caked or lumpy, it should be run through a tumbling barrel and sifted through at least 80-mesh screen. To keep practically the same metallic content, it is necessary to add to every charge, between 8% to 10% of virgin zinc dust. Weekly analysis of zinc dust should be made and the samples taken from the working zinc dust which has been sifted and well mixed together in one or several sherardizing drums.

In the question of temperature, it should be understood that there is practically no limitation. If a very long time for the process is allowed, low temperature could be used, but this is not practical and, therefore, a higher temperature will have to be reached. Also, the drums or containers are of metal and a working temperature must be of such a degree as not to destroy the working of the apparatus. In one case the temperature would be quite high and in another case it would be quite low.

Apparatus Feature

Any practical apparatus which would keep a uniform temperature throughout, would be advantageous, and, in this respect, the electrically heated drum would be the more suitable, as here the control of the heat as to uniformity, time and degree is ideal, and when electrical apparatus is used, 350 to 375° C. would be the most suitable temperature, as within this range a very practical and serviceable apparatus can be designed. There are some successful installations where gas as a means of heat is employed, and here the drums are passing through a continuous tunnel oven going gradually from the cold to the hottest zone and then to the cold.

The size of the container and construction have very much to do with uniformity of heat, as, if the dimensions are large, longer time is required to heat the apparatus. Zinc dust is a very poor conductor of heat and articles hardly touching each other do not offer a good path for heat.

Continuous rotation of the drums eliminates to a certain extent those disadvantages, since it produces a uniform mixing of the contents of the drum and allows the more heated particles on the outside to convect the heat to the centre. Packing the drum too tight will prevent a free flow of dust and heat, and consequently different temperature zones will occur with resulting different degrees of deposit.

Thickness of Deposit

After deposit of zinc begins, with all other factors well established, the thickness of the deposit depends solely upon the time. All other factors being constant, a good coating depends upon time, and if the process is continued too long, a brittle and easily chipped coating will result. This is due to the wide difference in co-efficient of expansion and contraction between the zinc and iron, which have co-efficients of .00002532 and .00001166 per degree centigrade, respectively.

The coating which is being deposited when the temperature is going up is the most dense and durable; next in quality will be the coating of the uniform temperature period and the least when the temperature is going down. If small articles are treated where sharp profiles and threads are present, the time element is most vital. It is very hard to establish

any certainty in the time element, but in every case it has to be established in accordance with other factors.

The relation of these vital factors to the process of sherardizing is such that each one is dependent on the other, with the result that the variation of the one will require a variation of the others. Therefore, in order to simplify the process and make it practical on a manufacturing basis, it is found that uniformity is the essential element. This is practically all that need be said on sherardizing, although much could be written on sherardizing for special conditions.

I have come in contact with practically every large sherardizing plant in the United States, and, with very few exceptions, they still have some trouble with the process. After analyzing the troubles, I found that the uniformity and relation of these factors was not properly maintained.

I know at least one concern which—by using shot air blasting; very uniform and high metallic content zinc dust, which is periodically cleaned and magnetically separated and sifted; which uses electrically heated drums of proper design, giving a controllable uniform temperature—obtain very desirable results on sherardizing. The purpose of this paper, however, is not to describe the everyday methods of sherardizing, but to point out the essential elements of the process.

The next step in sherardizing will be a continuous method in vacuum, for by this method, the narrow margins of the atmospheric pressure process will be broadened and more uniform results with less effort will be obtained.

CANADA WILL NOT MAKE BIG GUNS

IT is understood that Canada will not have a big gun industry just yet. The Imperial Government has decided not to proceed with the establishment of a plant for the manufacture of heavy artillery in Canada, for the present at least. Word was received in Ottawa recently to that effect.

At a conference which took place some weeks ago between military officials here and representative Canadian manufacturers and financiers, the question of constructing heavy guns was discussed and the opinion of the conference was that such an undertaking was feasible. Although it was never so stated officially, it is known that this opinion was confirmed subsequently by Sir Frederick Donaldson and General Mahon, who came to Canada to look over the ground at the instance of the War Office. These experts visited the various steel plants of Eastern Canada and conducted a thorough investigation into the resources which could be drawn upon for the construction of heavy guns. They returned to England on the completion of this investigation and are understood to have reported favorably upon the proposal to establish a big gun industry on a moderate scale.

The Imperial Government's reason in coming to an adverse decision is not known, although the question of time may have been one of the chief considerations. It has been stated that a Canadian artillery plant could not do very much in the way of output inside of six months. The establishment of such an industry would have meant a distribution of orders amounting to many millions, the proposal having been to have the parts manufactured at various points and assembled at one or two large plants in the East. Although the decision of the War Office does not preclude a renewal of the proposal at some future time, it is considered here to be unlikely that any further steps will be taken. It is pointed out, however, that there is plenty of work to be done in the production of shells and other munitions.

EFFECTIVE FORCE BETWEEN DRIVING BELT AND PULLEY

THE law of friction of solid bodies applies fully only to the case of surfaces of belts and pulleys clean and absolutely free of grease, and the nearest approximation is the case of new belts having very little grease on them. If, on the other hand, there clings, more or less perfectly, on the smooth surfaces of the belt and pulleys a thin skin of liquid, then, in accordance with the amount of its adhesion, the magnitude of the effective force varies as the internal friction of the liquid, and thus becomes functionally dependent on all other variables: in particular the effective surface, the gliding velocity, and the temperature and viscosity of the adhering liquid. Under such conditions new forces come into operation, in some cases many times greater than those acting in the case of pure friction between solid bodies. The properties of the belt material become of secondary importance, while the properties and amount of belt grease assume a pre-eminent importance.

Belt Grease Importance

The presence of a uniformly thin and smooth skin of grease on the gliding surface of a belt has a double effect. In the first place, it makes possible the rise of large forces between belt and pulley, especially with increase in gliding velocity. Second, it protects the surface of the belt. In particular, for high belt velocities, belts should be as flexible, soft and well greased as possible. In the case of a slightly greased belt, the application of a proper belt grease to the clean surface can help in building up a thin skin of grease between the belt and the smooth pulley which raises the effective forces as has been proved by experiments.

When there is a skin of liquid present, the magnitude of the effective forces increases, in the first place, with the gliding velocity. This makes the belt drive stable as regards overloads (up to certain definite limits of this latter); when large peripheral forces have to be transferred, higher gliding velocities must be used, and they lead to increased frictional resistances on the assumption that the temperature remains permanently constant. The average gliding velocity of the belt and pulley increases (all other conditions being the same and peripheral forces transferred being equal), approximately in proportion to the belt speed. In the high speed belts, therefore, usually larger frictional forces are in operation.

The superiority of large pulley diameters and comparatively wide belts, established by experiments, is partly explained by the functional dependence existing, in the case of well-greased belts, between the magnitude of the effective forces and that of the gliding surfaces.

With rough surfaces of pulleys the effective force is greater than with the smooth pulleys only when the velocity of gliding is negligibly small. Otherwise it is always smaller, the more so the more perfectly the face of the belt is covered by a thin skin of fluid. As a result rough pulleys not only cut down the life of the belt through increased wear, but they do not accomplish the purpose of increasing the frictional resistance in gliding.—Page's Weekly.

COLLINGWOOD SHIPBUILDING CO.

CONSIDERABLE activity is likely to be seen during the coming winter at the plant of the Collingwood Shipbuilding Co., Collingwood, Ont., not only in the production of new vessels, but in the matter of general repairs as well. Construction is approaching an advanced stage on the two vessels for the Imperial Oil Co., and as briefly noted in another section of this issue, an order has been secured for a large freighter, particulars of which are as follows: Length, 550 ft.; beam, 58 ft.; depth, molded, 31 ft.; gross tonnage, about 8,000; deadweight on 19 ft. 6 in. mean draft, 11,000 tons. Three Scotch type boilers each 13 ft. diameter by 11 feet long, will be installed, and the propelling machinery will consist of one set of triple expansion engines. The vessel will be built on the arch principle with deep double bottom and side tanks, the design being such as to enable either grain or coal to be carried

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"PLAYING UP" STEEL

THE more or less prevalent inactivity, long drawn out, on every section of a far-flung battle line, and the natural expectation that something big might materialize at any time, appear to have not only unsettled and unnerved our people to an extraordinary degree, but have engendered a disposition in many quarters to "start something" on their own initiative, irrespective of its having foundation on fact, or of the consequences.

We have in large degree got beside ourselves since the manufacture of war munitions became established in our midst. The paucity of orders placed with our manufacturers as compared with those distributed among American concerns; the disposition to keep Canadian contracts within a limited and select circle; the fault-finding with and whisperings of graft on the part of those charged with the administration of our public affairs; the glaring and unrestrained speculation in war stocks, and the giddy heights to which these have attained; the outcry to tax our manufacturers on their war profits, and the hysterical demand for a Minister of Munitions; these as constituting the more outstanding features of recent months may be cited as exemplary of the nervous tension under which we are laboring.

Each of the foregoing has attained to the full fever-heat of passion—in some the temperature excelled—but, in all, the cooling off is now in process. The whirl must needs be kept up, however, and just at the moment "steel" is in the ring, and overshadows all else. The gods of war, we are made believe, have decreed a steel famine, and, to challenge the possibility, no matter how reasonable one's deductions might indicate otherwise, would of course be futile. This steel famine cry has got to run its course, and will do so quite as worthily as its initiation deserves. It is unfortunate, however, that the cry has been raised, and perhaps more so that it has found so many adherents and supporters.

Steel prices covering every description of commodity into which the material enters have advanced to a prodigious extent, and we are quite certain that the limit has not nearly been reached. The demand for war munitions has brought about the extraordinary demand for steel, and the present hue and cry notwithstanding, there is little doubt but that the former will be satisfactorily met by the latter. Steel for structural purposes, outside of shipbuilding, is in but light demand, and that for otherwise and domestic requirements may not easily be assumed urgent. In any case, it is a question of price to be paid by the consumer, and is dependent on the latter's attitude—in war-time just as in peace-time.

A shortage is, we believe, imminent in billets and other forms of semi-finished steel, principally, of course, because of the extraordinary requirements of Britain and her Allies, and secondarlly because the domestic requirements of this North American continent begin again to loom up. Whether, however, the latter will continue to develop to any greater extent in the near future is problematical, in view of the fact that prices are already abnormally high, and give every evidence of reaching still more prohibitive figures.

Already we have reports that several large consumers of semi-finished steel contemplate the early closing down of their plants—at least temporarily. In spite of this, even if the reports have a meantime real foundation, we do not anticipate any such untoward happening. As we stated a few weeks ago, there are limitations to the extent that our big corporations are prepared to go as regards prices of raw and semi-finished steel, and exemplification of this is seen in the decision of the Pennsylvania Railroad System to take no further action meantime regarding the addition of some 11,000 freight cars to its rolling stock which it contemplated.

While agreeing that our domestic requirements may not be neglected, we cannot understand why apparently herculanean efforts should be made to boom them now, except it be to add impetus to the price raising propaganda. This domestic demand, as it is termed, has burst into an altogether too sudden prominence to be reckoned as enduring, and instead of the second quarter of the New Year marking the crucial or famine period, there is not a little possibility that the Allies, through the conservation now being enforced, will have both lessened the demand for munitions' steel from beyond their own borders, but will have materially lessened the market quotations for steel for all purposes everywhere.

We are still of opinion that no real domestic demand for steel will materialize until war prices of that commodity in any form tend downward towards those associated with peace-time activities. We also believe that the war needs of the Allies will be successfully met.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey forge, Pittsburgh	$16 45	
Lake Superior, charcoal, Chicago	17 25	
Ferro nickel pig iron (Soo)	25 00	
	Montreal.	**Toronto.**
Middlesboro, No. 3	$24 00	.....
Carron, special	25 00	.....
Carron, soft	25 00	.....
Cleveland, No. 3	24 00	.....
Clarence, No. 3	24 50	.....
Glengarnock	28 00	.....
Summerlee, No. 1	30 00	.....
Summerlee, No. 3	29 00	.....
Michigan charcoal iron.	28 00	.....
Victoria, No. 1	24 00	23 00
Victoria, No. 2X	23 00	23 00
Victoria, No. 2 plain..	23 00	23 00
Hamilton, No. 1	23 00	23 00
Hamilton, No. 2	23 00	23 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto..	2.50
Steel bars, f.o.b., Toronto........	2.75
Common bar iron, f.o.b., Montreal	2.50
Steel bars, f.o.b., Montreal	2.75
Twisted reinforcing bars	2.55
Bessemer rails, heavy, at mill....	1.25
Steel bars, Pittsburgh	...
Tank plates, Pittsburgh	...
Beams and angles, Pittsburgh....	...
Steel hoops, Pittsburgh	
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.75
Small shapes	2.75
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	2.10
Structural shapes	2.20
Plates	2.20

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal	Toronto
Plates, ¼ to ½ in., 100 lb.	$2 75	$2 50
Heads, per 100 lb.	2 80	2 75
Tank plates, 3-16 in.	3 00	2 80

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$13 75	$12 75
Copper, crucible	16 25	15 00
Copper, unch-bled, heavy	15 75	14 50
Copper, wire, unch-bled..	15 75	14 50
No. 1 machine compos'n	12 00	11 75
No. 1 compos'n turnings	11 00	10 00
No. 1 wrought iron	10 00	9 50
Heavy melting steel	9 00	9 00
No. 1 machin'y cast iron	13 50	13 00
New brass clippings	11 50	11 00
No. 1 brass turnings ...	9 50	9 00
Heavy lead	5 25	5 00
Tea lead	$ 4 25	$ 4 00
Scrap zinc	13 50	12 00

W. I. PIPE DISCOUNTS.

Following are Toronto jobbers' discounts on pipe in effect Nov. 5, 1915:

	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
Standard				
¼, ⅜ in.	62	38½	....	....
½ in.	67	47½	....	....
¾ to 1½ in. ..	72	52¼	....	....
2 in.	72	52½	68	48½
2½ to 4 in. ...	72	52½	71	51½
4½, 5, 6 in...	....	....	69	49½
7, 8, 10 in. ...	....	....	66	44½
X Strong P. E.				
¼, ⅜ in	55	38½	....	....
½ in	62	45½	....	....
¾ to 1½ in. ..	66	49½	....	....
2, 2½, 3 in. ..	67	50½	....	....
2 in.		....	62	45½
2½ to 4 in		....	65	48½
4½, 5, 6 in.		....	65	48½
7, 8 in		....	58	39½
XX Strong P. E.				
½ to 2 in	43	26½	....	....
2½ to 6 in.		....	42	25½
7 to 8 in.		....	39	20½
Genuine Wrot Iron.				
⅜ in	56	32½	....	....
½ in	61	41½	....	....
¾ to 1½ in. ..	66	46½	....	....
2 in.	66	46½	62	42½
2½, 3 in.	66	46½	65	45½
3½, 4 in.		....	65	45½
4½, 5, 6 in.		....	62	42½
7, 8 in.		....	59	37½

Wrought Nipples.

4 in. and under	77½%
4½ in. and larger	72%
4 in. and under, running thread.	57½%

Standard Couplings.

4 in. and under	60%
4½ in. and larger	40%

MILLED PRODUCTS.

Sq. & Hex Head Cap Screws	65 & 5%
Sq. Head Set Screws	70 & 5%
Rd. & Fil. Head Cap Screws.....	45%
Flat & But. Head Cap Screws....	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in.	70%
Semi-Fin. Nuts up to 1 in.	70%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

METALS.

	Montreal.	Toronto.
Lake Copper, carload ...	$21 50	$20 75
Electrolytic copper	21 25	20 50
Castings, copper	21 00	20 50
Tin	46 00	46 00
Spelter	20 00	21 00
Lead	6 75	7 00
Antimony	42 00	40 00
Aluminum	62 00	65 00

Prices per 100 lbs.

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh...	$28 00
Open-hearth billets, Pittsburgh..	29 00
Forging billets, Pittsburgh	50 00
Wire rods, Pittsburgh	38 00

NAILS AND SPIKES.

Standard steel wire nails, base	$2 70	$2 75
Cut nails	2 50	2 70
Miscellaneous wire nails..	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	60 and 5
Stove bolts	82½
Plate washers	40
Machine bolts, ⅜ and less	65
Machine bolts, 7-16 and over	50
Blank bolts	50-7½
Bolt ends	50-7½
Machine screws, iron, brass.....	35
Nuts, square, all sizes	3¾c per lb off
Nuts, hexagon, all sizes...	4¼c per lb. off
Iron rivets	67½
Boiler rivets, base, ¾-in. and larger	$3.75
Structural rivets, as above	3.75
Wood screws, flathead, bright	85, 10, 7½, 10 p.c. off
Wood screws, flathead, brass	75 p.c. off
Wood screws, flathead, bronze	70 p.c. off

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Standard. Price. per ft.	Extra Strong. Sizes Ins.	Extra Strong. Price per ft.	D. Ex. Strong. Size	D. Ex. Strong. Price per ft.
⅛in	$.05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1¼in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	....
7 in	2.38	7 in	3.81	....	....
8 in	2.50	8 in	4.34	....	....
8 in	2.88	9 in	4.90	....	....
9 in	3.45	10 in	5.48	....	....
10 in.	3.20	....	....	....	....
10 in.	3.50	....	....	....	....
10 in.	4.12	....	....	....	....

COKE AND COAL

Solvay Foundry Coke	$6.25
Connellsville Foundry Coke	5.65
Yough Steam Lump Coal	3.63
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

COLD DRAWN STEEL SHAFTING

At mill	25%
At warehouse	20%

Discounts off new list. Warehouse price at Montreal and Toronto.

MISCELLANEOUS

Solder, half-and-half	0.25
Putty, 100-lb. drums	2.70
Red dry lead, 100-lb. kegs, per cwt.	9.65
Glue, French medal, per lb.	0.15
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.25½
Benzine, single bbls., per gal.	0.25
Pure turpentine, single bbls.	0.85
Linseed oil, raw, single bbls.	0.85
Linseed oil, boiled, single bbls.	0.88
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.50
Lead Wool. per lb.	0.11
Pure Manila rope	0.16
Transmission rope, Manila	0.20
Drilling cables, Manila	0.17
Lard oil, per gal	0.73
Union thread cutting oil	0.60
Imperial quenching oil	0.35

POLISHING DRILL ROD

Discount off list, Montreal and Toronto 40%

PROOF COIL CHAIN.

¼ in.	$9.00
5-16 in.	5.90
⅜ in.	4.95
7-16 in.	4.55
½ in.	4.00
9-16 in.	4.20
⅝ in.	4.10
¾ in.	3.95
⅞ in.	3.80
1 inch	3.70

Above quotations are per 100 lbs.

TWIST DRILLS

	%
Carbon up to 1½ in.	55
Carbon over 1½ in.	25
High Speed	
Blacksmith	55
Bit Stock	60 and 5
Centre drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Centre	25
Pipe Reamers	80

Discounts off standard list.

IRON PIPE FITTINGS.

Canadian malleable, A, 25 per cent.; B and C, 35 per cent.; cast iron, 60; standard bushings, 60 per cent.; headers, 60; flanged unions, 60; malleable bushings, 60; nipples, 75; malleable, lipped unions, 65.

TAPES

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3.50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$3.20	$3.20
Canada plates, dull, 52 sheets	3 25	3 25
Canada Plates, all bright	4 60	4 75
Apollo brand, 10¾ oz. galvanized	5 50	5 75
Queen's Head, 28 B.W.G.	6 00	5 95
Fleur-de-Lis, 28 B. W. G.	5 75	5 75
Gorbal's Best, No. 28	6 00	6 00
Viking metal, No. 28	5 25	5 25
Colborne Crown, No. 28	5 70	5 80
Premier No. 28	5 40	5 50
Premier, 10¾ oz.	....	5 75

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$14 25	.....
1¼ in.	15 00	.....
1½ in.	15 00	.....
1¾ in.	15 00	.....
2 in.	15 00	9 50
2¼ in.	16 50	10 50
2½ in.	17 50	11 00
3 in.	25 00	12 50
3½ in.	28 00	15 00
4 in.	33 00	19·00

Prices per 100 feet, Montreal and Toronto.

WASTE.

WHITE.	Cents per lb.
XXX Extra	0 11½
X Grand	0 11
XLCR	0 10¼
X Empire	0 09½
X Press	0 08¾
COLORED.	
Lion	0 07¾
Standard	0 07
Popular	0 06¼
Keen	0 05½
WOOL PACKING.	
Arrow	0 17
Axle	0 12
Anvil	0 09
Anchor	0 07
WASHED WIPERS.	
Select White	0 08½
Mixed Colored	0 06¼
Dark Colored	0 05¼

This list subject to trade discount for quantity.

BELTING RUBBER

Standard	50%
Best grades	30%

BELTING—NO. 1 OAK TANNED.

Extra heavy, single and d'ble,	40 & 10%
Standard	50%
Cut leather lacing, No. 1	$1.20
Leather in sides	1.10

ELECTRIC WELD COIL CHAIN B.B.

⅛ in.	$12.75
3-16 in.	8.85
¼ in.	6.15
5-16 in.	4.90
⅜ in.	4.05
7-16 in.	3.85
½ in.	3.75
⅝ in.	3.60
¾ in.	3.60

Prices per 100 lbs.

PLATING CHEMICALS

Acid, boracic	$ .15
Acid, hydrochloric	.05
Acid, hydrofluoric	.06
Acid, nitric	.10
Acid, sulphuric	.05
Ammonia, aqua	.08
Ammonium carbonate	.15
Ammonium chloride	.11
Ammonium hydrosulphuret	.35
Ammonium sulphate	.07
Arsenic, white	.10
Copper sulphate	.10
Cobalt sulphate	.50
Iron perchloride	.20
Lead acetate	.16
Nickel ammonium sulphate	.10
Nickel carbonate	.50
Nickel sulphate	.15
Potassium carbonate	.40
Potassium sulphide (substitute)	.20
Silver chloride (per oz.)	.65
Silver nitrate (per oz.)	.45
Sodium bisulphite	.10
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.35
Sodium hydrate	.04
Sodium hyposulphite (per 100 lbs.)	3.00
Sodium phosphate	.14
Tin chloride	.45
Zinc chloride	.20
Zinc sulphate	.07

Prices Per Lb. Unless Otherwise Stated.

ANODES

Nickel	.47 to .52
Cobalt	1.75 to 2.00
Copper	.22 to .25
Tin	.45 to .50
Silver	.55 to .60
Zinc	.22 to .25

Prices Per Lb.

PLATING SUPPLIES

Polishing wheels, felt	1.50 to 1.75
Polishing wheels, bullneck.	.80
Emery in kegs	4½ to .06
Pumice, ground	.05
Emery glue	.15 to .20
Tripoli composition	.04 to .06
Crocus composition	.04 to .06
Emery composition	.05 to .07
Rouge, silver	.25 to .50
Rouge, nickel and brass	.15 to .25

Prices Per Lb.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Nov. 29, 1915.—The closing days of November show continued improvement in the trade conditions that have prevailed for the past few months, and the general feeling is that developments in this direction will be maintained. The exceptional open weather of the past few weeks is responsible for a record being made in the navigation history of the St. Lawrence, the present week being the latest in the history of the river that the gas buoys have been in place for night navigation. The last departure for a sea voyage is scheduled for November 30. Shipping companies have benefited greatly by the extension of harbor closing.

With the closing of navigation, increased activity will be manifest in the operation of the various railway systems, and their full equipment and rolling stock will be requisitioned to handle the transportation of goods to foreign ports.

The activity in the manufacture of supplies for the allied armies continues unabated. Orders have been awarded to manufacturers in this district for 600,000 pairs of shoes, and this may be added to at any time. The capacity of our cotton mills is taxed to the utmost to supply the domestic and army needs. Colored goods are subject to heavy advances, due to the inability to secure the necessary dyes.

Great inconvenience, we understand, is being experienced by Western farmers in certain districts, because the unprecedented crops have overcrowded the available capacity of the grain elevators; in many instances large quantities of bagged grain being stacked in the open field and inadequately protected from weather conditions. Although the C. P. R. are now moving twelve miles of loaded cars per day, the closing of lake navigation tends to make the storage and transportation problems ever present sources of anxiety to our farmers.

The war, while a devastating agent in many respects, has opened the way for a great future for this country. Many lines of industry previously little known in our midst, have developed remarkable proportions. The inability to secure much-needed chemicals (formally imported from Austria and Germany) has given great impetus to their local manufacture, and many plants have been erected and are now working to capacity supplying what a few years ago was deemed impossible.

Public opinion is being and will continue to be educated along stimulating and constructive lines, and with the coming years there are bound to come further unheard-of developments in Canada's industrial position.

Pig Iron

Production of pig iron is being maintained as fast as our blast furnaces can reduce the ore. Further price advances are, of course, expected.

Steel

The abnormal conditions at present prevailing in the steel situation show little variation from the previous week. Contemplated placing of further orders for British, French and Russian shells will not only add activity to the steel producing industries, but will also increase the difficulty of securing an ample supply of steel.

The probability of a shortage in the steel supply is being discussed, and prophesies are that a few plants may be temporarily shut down. Domestic requirements have been greatly affected by the present European situation. For many years the Krupp works in Germany have supplied certain brands of steel in this connection, but with the opening of hostilities this source of supply was suddenly cut off. The manufacture of these particular grades of steel had been given little attention on this continent. The past year has, however, shown great developments in the production of steels previously made in foreign countries, with the result that today this grade of steel has not only been duplicated, but the possibilities are that the improvement will exceed the highest expectations of its producers. Thus, it may be said that, although the war has had terrible results in many ways, the necessity of the times has forced the American and Canadian manufacturers to develop resources that have until now been lying dormant.

Boiler plates have shown strength during the week, and are now quoted at \$2.75; heads, 30 inches and over, \$2.80; and tank plates, \$3.

Sheets are holding firm, with an advance likely in the near future.

CANADIAN GOVERNMENT PURCHASING COMMISSION

The following gentlemen constitute the Commission appointed to make all purchases under the Dominion \$100,000,000 war appropriation:—George F. Galt, Winnipeg; Hormidas Laporte, Montreal; A. E. Kemp, Toronto. Thomas Hilliard is secretary, and the commission headquarters are at Ottawa.

Machine Tools and Supplies

Domestic requirements are commencing to add increased pressure to those of the war for machines and equipment. Some machine tool builders, who contemplate making additions to their plants, are uncertain of being able to secure the necessary help to operate same. While this might be true in some localities, the general impression, however, is that sufficient help will be available to maintain any increased output required.

Automobile makers are continually adding to their equipment, and much increased production along these lines is looked for this winter and during the spring of 1916.

The continued demand for supplies to maintain shell production is keeping the prices of these commodities firm and steady. The heavy demand for high-speed steel continues and quotations of \$2.50 upwards are still in force. Prices on all supplies are holding firm.

Metals

The general condition of the metal market shows little change, with the exception of copper and tin. The former, due to increased domestic demand, has advanced, while the latter has dropped below last week's price.

Copper.—The strength of the market this week is due to the increased demand for domestic purposes. However, if the war requirements have a tendency to force the price much higher, the domestic demand may be somewhat curtailed, as the increase in price will undoubtedly effect the consumption for ordinary purposes. The mine production at the present time is large, but this could possibly be increased about 5 per cent. The probability of continued war demands will likely call for a further advance. With the increase noted this week, the quotation on lake copper, carload, is \$21.50 per 100 pounds.

Tin.—Both buyers and sellers are showing little interest in spot or future deliveries, and the market is dull and inactive. Present quotation of \$46 shows a decline of \$2 over the previous week.

Spelter.—Despite foreign firmness in spelter, the local market is quiet. However, the prices are holding steady, and no advance falls to be registered. The consumption is not exceeding the supply, and no price change is expected. The market is steady at \$20.

Lead.—The demand at present is not heavy, and the market is not active. The quotation of \$6.75 prevails.

Aluminum.—No change is shown in aluminum, and the market is firm at 62c per pound.

Antimony.—This is firm, 42c being quoted.

Old Materials

The remarkable activity in the scrap metal market during the past week has created much excitement among dealers. Trading in old material of every description is general, and prices have advanced in every direction. While heavy melting steel scrap has shown no advance, the possibilities are that future quotations will show an increase. The stiffening of all grades of scrap is a feature of this week's business.

Toronto, Ont., Nov. 30.—An interesting development affecting the steel industry is the announcement that plans are being worked out for extending the scope of the Munitions Committee to include the distribution of orders for shells from all the Allies. Another interesting feature is a proposal for Canadian banks to assist factories in financing orders for shells. An arrangement such as this will permit of larger orders being handled and greatly simplify the financial aspect of the business. Hitherto all payments have been made in British funds. No very definite information is available with regard to the 8-in. and 9.2-in. shells, but it is understood that orders for 60-pdr. and 6-in. shells are being placed first.

The reorganization of the Shell Committee has been completed and the new body will be known as the Imperial Munitions Board. J. W. Flavelle of this city has been appointed chairman, and General Alex. Bertram deputy-chairman. A Commission has been appointed to enquire into the supply of raw materials for the production of munitions. Col. Thomas Cantley will be Chairman of the Commission.

Industrial conditions continue to steadily improve and a more optimistic feeling prevails in business circles with regard to the outlook for the future. Money is circulating more freely, railway earnings are increasing, and the volume of business is growing notwithstanding a steady advance in prices of many lines. The volume of exports is also increasing each month, thus improving the financial condition of the country.

Steel Market

The market continues very active and prices are holding very firm with a decided upward tendency. The demand for steel, particularly for shells, is on the increase, and mills are getting behind on deliveries, notwithstanding plant extensions which have been made to cope with the business. Steel bars are firm at 2.75c and iron bars are unchanged at 2.50c, but an advance is looked for in the near future. Wire nails have advanced again and are now quoted at $2.75 base, per keg. Boiler plates and lapwelded boiler tubes are higher. A new list for bolts and nuts has been issued, the prices showing a slight increase over the previous list. A new discount of 25 per cent. for cold drawn steel shafting is announced. Prices of proof coil chain and electric weld chain have been revised. The new discount on iron rivets 7-16-in. and less is 67½ per cent., and copper wire is now 30 per cent. off list. Smooth steel wire has advanced and is now quoted at $2.85 base.

The galvanized sheet market is extremely irregular. There is an increasing scarcity of steel and black sheets are therefore rising in price. Spelter is being maintained at a level too high to be attractive to the makers of galvanized sheets; in addition there is a shortage of sulphuric acid. This combination of circumstances is affecting the market and prices of sheets cannot help but advance. "Apollo," 10¾ oz., are now quoted at $5.75, and "Premier" No. 28, at $5.50. In some cases, sellers have done away with the regular differentials and are basing prices for each gauge on its cost. Some mills are said to be refusing to quote on galvanized sheets on account of operations having been cut down due to the acid and spelter situations. Black sheets are quoted at 2.40c to 2.75c Pittsburgh, and blue annealed 2.10c to 2.25c Pittsburgh.

In the States there is no cessation in the demand, which on nearly all lines of steel products, is beyond the capacity of the mills to supply. The majority of steel companies have sold their output for the first quarter of 1916 and have enquiries extending into the second quarter. Some authorities believe that prices have reached a danger point and any further advances should be prevented if possible. There is little indication, however, that prices have reached the top level. It is reported from London that the Allies can now manufacture all the munitions they require. Even if this is the case they will still need steel, as the output of steel has not increased in the same proportion as munitions. Heavy tonnages of steel will be required for other purposes. Prices continue to advance in many steel products; steel bars, however, are unchanged at 1.70c. Beams are higher at 1.70c, Bessemer billets $28, open-hearth billets $29, and forging billets $50 base, Pittsburg. Prices of billets are nominal owing to the shortage in Bessemer and open-hearth steel.

ALLIES PURCHASING AGENTS

The Trade and Commerce Department, Ottawa, has published the following list of purchasing agents for military purposes for the allied Governments:

International Purchasing Commission, India House, Kingsway, London, Eng.

French.—Hudson Bay Co., 56 McGill Street, Montreal; Captain Lafoulloux, Hotel Brevort, New York; Direction de l'Intendence Ministere de la Guerre, Bordeaux, France; M. De la Chaume, 28 Broadway, Westminster, London.

Russian.—Messrs. S. Ruperti and Alexsieff, care Military Atache, Russian Embassy, Washington, D.C.

Pig Iron

The market is very active and prices of domestic brands of pig iron have again been advanced; Hamilton and Victoria brands are $1.25 higher than last week and are now quoted at $23 ton. Grey forge, Pittsburgh, has advanced and is quoted at $16.45. There is a heavy demand for steel-making grades of iron, but foundry iron is less active.

Old Materials

Conditions in the market for old materials are much the same as last week and prices are practically unchanged, although firmer for some scraps. Copper and zinc scrap are both very firm and have a higher tendency. Heavy melting steel is strong but No. 1 wrought iron is weaker, and is now quoted at $9. Copper and heavy melting steel are in good demand but other lines are quiet.

Machine Tools

Business has been fairly good in machine tools this week but it is expected that there will be heavier demand later when the large orders contemplated are placed. A number of orders for machinery for the 6-in. and 60-pdr. shells have been booked, but nothing has been done as yet with regard to equipment for the large shells. There is a good demand for second-hand tools, but these are getting somewhat scarce. Prices are still high and deliveries do not show much improvement. An interesting development in the trade of recent date is the taking over of the Russell Motor Car plant by the Willys-Overland Co. It is stated that extensions will be made to increase the output.

Supplies

An advance of 2c per gallon for gasoline and benzine are the only price changes to note this week. There is a great scarcity of gasoline on account of heavy shipments from the States to Europe owing to some of the larger fields being in enemy countries. Turpen-

tine is very firm and may go higher. Linseed oil is unchanged, but prices are irregular. Business continues very active with a good demand for most lines. Prices on high-speed twist drills are still withdrawn.

Metals

The situation in the metal market shows no appreciable change from last week. Copper continues strong and has advanced slightly. The tin market has reacted and is lower, following a decline in London. The spelter market is quiet and unchanged. Zinc ore is very high, being quoted $100 to $115 at Joplin, Mo. The lead market is very strong both in London and New York. The antimony market is strong and scarcity of supplies is being felt. Aluminum is also scarce and quotations are nominal.

Tin.—The market is dull and featureless with prices lower. There continues to be little interest shown by buyers for any deliveries, at the same time sellers are inclined to be indifferent. Tin has declined 2c and is being quoted at 46c per pound.

Copper.—The market is strong and higher and the position of copper is a decidedly strong one. Consumption is increasing and is, if anything, in excess of the current output. Lake copper is now quoted at 20¾c and electrolytic at 20½c per pound.

Spelter. — The market advanced in London. but this did not stimulate the New York market. The situation is practically unchanged and indications point to higher prices rather than otherwise. Spelter is unchanged at 21c per pound.

Lead.—Both London and New York markets are very strong. The "Trust" price of 5.25c New York is being firmly held with a possibility of an advance. Lead is unchanged locally at 7c per pound.

Antimony.—The market is in a stronger position than it has been and is feeling the full effects of the scarcity of supplies. Quotations locally are firm but unchanged at 40c per pound.

Aluminum.—There is no improvement in the situation with regard to supplies. which are very difficult to obtain. Quotations are nominal at 65c per pound.

IMPERIAL MUNITIONS BOARD CONSTITUTED

ADVICES from Ottawa give particulars of the constitution of what will in future be known as "The Imperial Munitions Board." This body displaces the Dominion Shell Committee in the management and distribution of contracts for the various munitions requirements of the Imperial Government. The reconstructed board has at its head J. W. Flavelle, of Toronto, who will act as chairman, with executive and administrative powers. Brig.-Gen. Bertram, former head of the Shell Committee, will in future hold the position of deputy chairman, with the following others comprising the board:—Hon. Col. David Carnegie (member of the Shell Committee), G. H. Dawson, C. B. Gordon, J. A. Vaillancourt and E. R. Wood, the latter four being new members.

The new chairman is head of the William Davies Packing Co., and was appointed a member of the recently-formed Dominion Economic Commission. Mr. Gordon is head of the Dominion Textile Co. Mr. Vaillancourt is president of the Bank of Hochelaga. Mr. Dawson is now a resident of Victoria, B.C. Mr. Wood is a well-known Toronto financier, and is closely connected with the Mackenzie & Mann interests. Mr. Gordon is a well-known Montreal manufacturer. Sir Sam Hughes becomes honorary president of the board.

Commission on Raw Materials

In addition to the forming of the above new board, a commission has been established to make inquiry into the supply and sufficiency of raw materials in Canada required for the production of munitions of war, and as to the best methods of conserving same. The following are the members of this new commission: Col. Thomas Cantley, head of the Nova Scotia Steel & Coal Co., New Glasgow; E. Carnegie, Welland; Geo. W. Watts, Toronto; Robert Hobson, Hamilton; Senator William C. Edwards, Ottawa, and Geo. G. Mackenzie, B.Sc., Superintendent of Mines, Ottawa. Messrs. Cantley, Carnegie and Watts were members of the original Shell Committee.

N. T. R. TRANSCONA SHOPS TO MAKE MUNITIONS

IT is reported that the Government has leased the Transcona shops, near Winnipeg, of the N. T. R., to a powerful private company, organized for the manufacturing of shells and war munitions generally. These shops, which are part of the equipment of the National Transcontinental Railway, and which were erected and fitted with the most modern machinery procurable, are well adapted for the manufacture of shells, but have been practically idle since the war broke out.

The personnel of the company has not been definitely learned. It is known that the Mackenzie & Mann interests have been negotiating for some time for a lease of the shops for the purpose mentioned, but whether that company has secured the lease or not is not learned. A rumor to the effect that Sir Herbert Holt, of Montreal, and a group of other financial men have secured the lease is current.

The Government has had a splendid opportunity of contributing toward the shell supply of the allied armies at reasonable prices by the utilization of both the Transcona and Leonard shops, but both of these institutions have been left practically idle while companies have been formed all over the Dominion and new plants established for the manufacture by private individuals of shells at large profits.

It is understood that the men now employed in the Transcona shops have been notified that after a certain named date they were to look to the new company for their salaries, and not to the Government. Only a portion of the shops will be retained by the Government for the ordinary work of railway rolling stock repairs.

SHELL ORDERS FOR ALLIES

THE scope of the Canadian Shell Committee, or the Imperial Munitions Board as it is now called, may be enlarged before long to include the placing of orders for both the French and the Russian Governments.

Thus far the committee has had charge of the placing of munition orders in Canada for the Imperial authorities only. British orders have had the preference all along with Canadian manufacturers, for obvious reasons.

The shell making capacity in Canada, however, has now increased to a point that will probably permit of Canadians assisting in the manufacture of munitions for both the French and the Russian Governments on a fairly large scale, and in well-informed circles it is stated that proposals looking towards the extension of the Munitions Committee's activities are now actively under consideration.

If the proposals are carried out, an important feature will be the unification of the work. Instead of individual firms going after orders which they understand are under negotiation, the Munitions Committee will be able to act as a central bureau, bringing the Russian and French authorities into touch with the manufacturers. This will permit of business on a much larger scale than could be attempted if individual effort were depended upon, and the results should be satisfactory to both the Allied Governments and the Canadian manufacturers.

Major George Janin, city engineer of Montreal, who commanded a corps of engineers which he raised himself for war service, was drowned when the hospital ship Anglia sank after striking a mine. Major Janin was born in Paris, and saw service in the Franco-Prussian war. He was city engineer for twenty years.

Large Shells: Production Problems and Possibilities--IV.

By C. T. D.

In preparing to undertake the production of large shells up to 9.2 in. dia., manufacturers will encounter problems of a nature altogether different from those connected with 18 pdr. shells. Automatic machinery will not be so applicable to the larger sizes, and productive ability will centre largely on such points as sequence of operations, tooling methods, etc.

THE operations referred to in group C present no great difficulty. The principal dimensions and surfaces by which the work is to be held, driven, located or measured have already been established and these operations call for little remark further than indications as to chucking and driving methods.

Operation C 1 can be performed to advantage in any available drill press. A tubular chuck of generous dimensions is accurately located under the drill spindle. This chuck is made with one half hinged to open like a door to admit the shell from the side and avoid having to lift it up and lower it endwise. While the

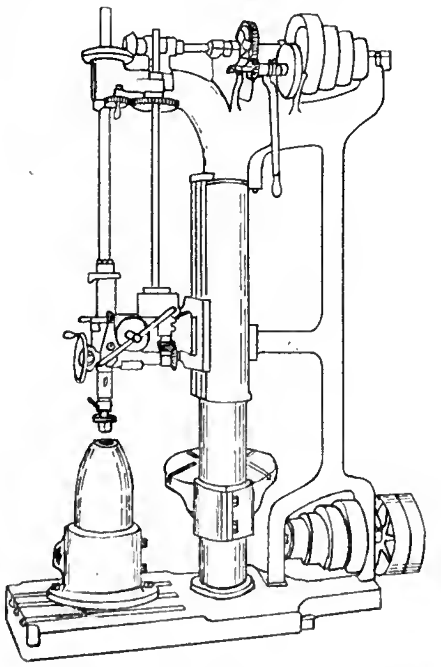


FIG. 9. TAPPING NOSE IN DRILL PRESS.

catch-bolt is being tightened, the shell should be shaken so as to ensure its being held perfectly vertical. This may be further insured by relieving the side walls of the chuck so that it grips the shell at the top and bottom of the parallel portion.

A service plug is now inserted in each end of the shell. These plugs should be accurately made to gauge size and hardened. In order to save time later, the nose plug may be made in the form of an eyebolt, or if desired, it may have a substantial boss, preferably of square shape, through which a shackle bolt may be passed.

The simplest form of driving plug for the base end would be provided with a square boss to engage with a driver in the face plate of the lathe. Turning the

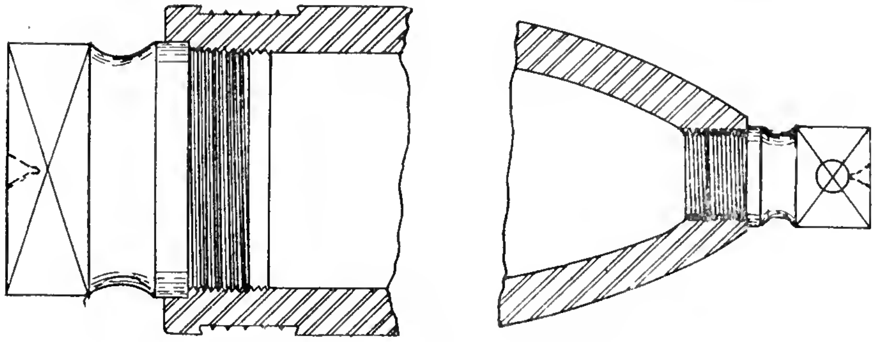


FIG. 10. SERVICE PLUGS FOR BASE AND NOSE.

shell to finished diameter, and forming the profile is accomplished with any of the numerous types of attachments already in use on small shells.

The base end of the shell having been previously faced, so as to bring the overall length of the shell within definite limits, this surface may now be used as a point from which to gauge the form of the shell, the gauge and method of applying it being shown in Fig. 11.

To avoid undue complications on the carriage, grooving and waving are most efficiently performed on a machine specially fitted up for this operation. Owing to the slight differences in centres and plugs, there may occur variations in the exact locations of successive shells necessitating the provision of means for adjusting the grooving and waving tools to suit. This is avoided by chucking the base of the shell, with the end positioning from a step in the jaws.

The shell is now ready to receive the driving band after the necessary chisel cuts have been put in the waves. The radial type of press with converging cylinders is best adapted for work on large shells. The nose plug which has been retained in place is now used for

OPERATION TABLE.

Operation Number	Description.
	Group A.
1	Grind off scale on point, forming small flat.
2	Place on expanding arbor which locates shell from inside, and positions it lengthwise from inside of nose.
3	Face-off nose of shell to necessary thickness.
4	Drill centre with drill in tail stock, remove drill and adjust dead centre.
5	Rough turn body, commencing at nose and traveling to point where open end of shell is cut on.
6	Cut off open end of shell to length measured from nose.
	Group B.
1	Drill hole in nose, leaving stock for final boring.
2	Chuck by nose with outer end in steady. Nose of shell in contact with gauge stop on chuck.
3	Bore parallel portion with roughing and finishing cutters.
4	Form interior of nose or arch.
5	Finish overall length and counterbore. Tap base.
	Group C.
1	Tap nose.
2	Insert threaded driving plug centre in base, and common threaded plug centre in nose.
3	Finish outside to size and shape.
4	Machine and undercut groove. Wave ribs.
	Group D.
1	Press on driving band.
2	Machine driving band.
	Group E.
1	Remove service plugs and assemble base plug and nose bushing.
2	Face off base and finish bushing.
3	Enamel interior and bake.

suspending the shell from suitable tackle. The service plugs may be removed now or left in place till after the band is machined. As a matter of safety both for the operator and the finished band it is preferable to remove the base plug now, replacing it with the proper article. This procedure offers the opportunity of facing off the plug in the machine which turns the band, and if the shell has been thoroughly cleaned out previously, the service plug in the nose will have prevented the entrance of any foreign matter, so that when it is removed, the shell may be varnished and baked without further delay.

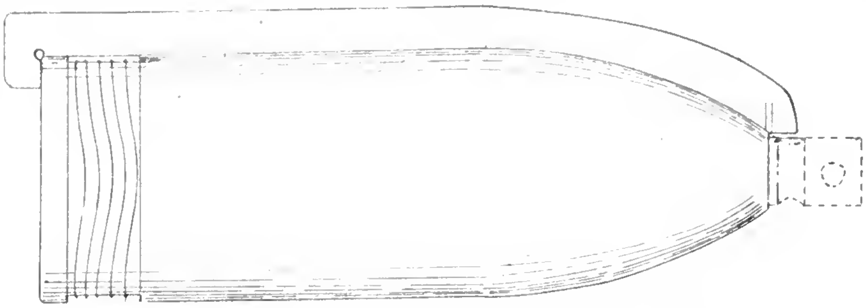


FIG. 11. GAUGE FOR OVERALL LENGTH AND PROFILE.

Single Purpose and Other Special Machines

As previously mentioned, the operations referred to above are arranged with a view to making immediate use of existing machines. The economies to be affected by the adoption of special purpose machines will not be overlooked by progressive manufacturers, and the foregoing methods will be adhered to just so long as they serve their purpose in other words when special machinery is obtainable, both machines and methods will be considerably rearranged so that as facilities for increased output become available, the older type machines will be relegated to such minor operations as they are best suited for.

Single purpose machines for boring, profiling, thread milling, and band turning are being rapidly placed on the market, and with reasonable delivery, manufacturers in this country should be able to proceed with work on the forgings as soon as they are received.

Through the courtesy of various tool building concerns, it is possible to illustrate and describe some of the more interesting machines which have been developed for handling the larger sizes of shells.

The Amalgamated Machinery Corporation of Chicago, have placed on the market a line of special ammunition machines, in two sizes, one for shells up to and including 4.5 in. and the other from 4.5 in. up to and including 12 in. These machines are all that are necessary for all roughing and finishing operations where the work revolves against a stationary tool. Strength has been especially regarded in their design and they are amply capable of performing any service required.

For the larger size shells, four machines have been designed, for turning, boring, drilling, and trimming.. These are all single purpose machines, and are naturally more effective than ordinary lathes, drills, etc., on repetition work.

Two of the larger size machines are illustrated herewith. The No. 21 turning machine, see Fig. 12, weighs approximately 18,000 lbs. The carriage has quick power return, with automatic stops for both directions. Power is received through a 16-in. x 12-in. pulley, and transmitted through a double back-geared drive to the spindle, the gear reduction being 16 to 1. A choice of any one of nine feeds is offered, from .026 in. to .200 in. per spindle revolution. The

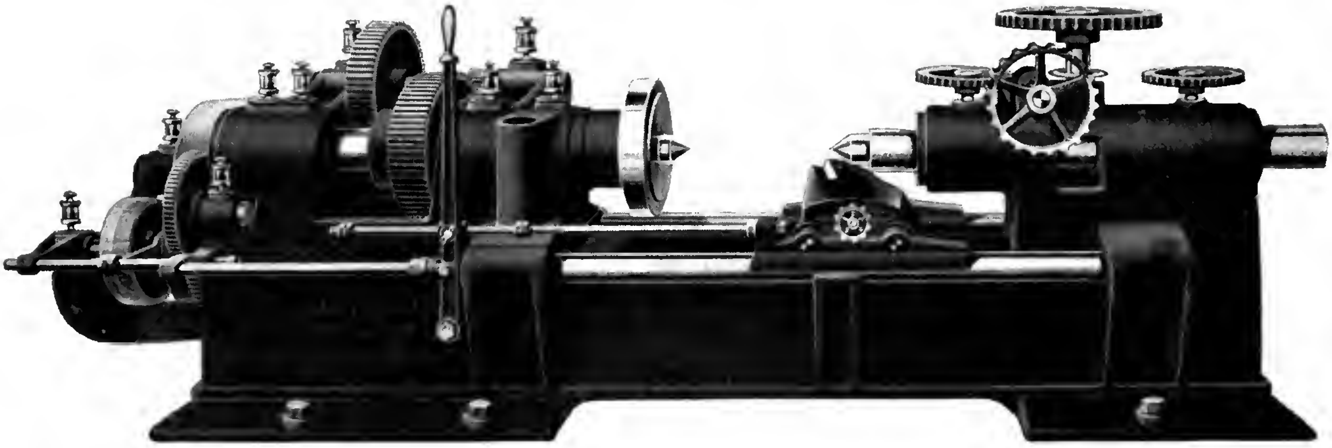


FIG. 12. SINGLE PURPOSE MACHINE FOR TURNING SHELLS FROM 4.5 IN. to 12 IN. DIA.

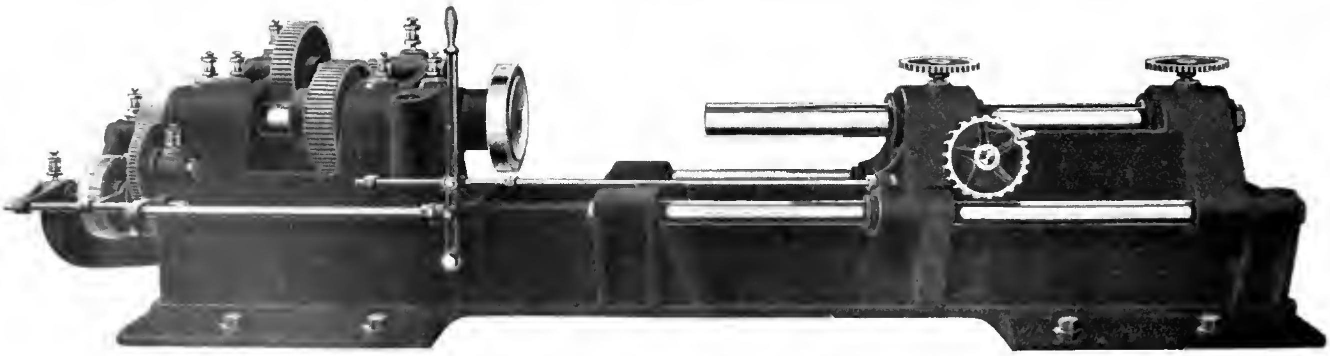


FIG. 13. DRILLING MACHINE FOR BORING LARGE SHELLS

regular feeds are .031 in. for machines on finishing, and .059 in. on machines doing roughing operations.

A feature of the carriage operation is the independent quick return which is directly driven by belt to friction pulley on the feed screw, and this travel is independent of the spindle and may occur while the spindle and work are at rest. Both feed and quick return are at all times under the control of the operator by means of a single hand lever conveniently placed, and adjustable automatic limit stops are provided for the carriage travel in both directions.

The tool holder will take a 1¼-in. square tool, which is seated in a pocket machined in the tool slide at a suitable angle and inclination, so that forging and grinding on the tool are reduced to a minimum. The spindle, which is 5 15-16 in. dia. of high-carbon steel accurately ground, is furnished with plain nose, attachment face-plate, No. 7 Morse taper centre, plain or with any specified fixture sleeve shrunk on, at purchaser's option. These machines are regularly furnished with former attachment, and one former made to purchaser's requirements.

The tailstock proper is cast integral with the frame and headstock, and is provided with ample clamping facilities to maintain it perfectly rigid. The actual swing over ways is 27½ in., over carriage 13 in., and floor space required is 4 ft. x 17 ft.

The No. 23 drilling machine, Fig. 13, made by the same firm, is similar in general features to the machine just described, the driving gear and headstock being identical. The tailstock is replaced by a carriage having an extreme length of bearing on the ways of 67 in., and a travel of 44 in. Longitudinal feed by hand is provided, which may be operated alone, or at the same time as the power feed, to accelerate or retard the latter, the length of travel being 44 in.

An option of any one of fifteen different power feeds is offered, from .006 in. to .200 in. per revolution of spindle, while an independent quick return by 4-in. belt drive is provided. Two widely separated supports for 5 15-16-in. bar or tool holder with powerful clamping devices are provided on the carriage, which is properly aligned with the spindle. Ample thrust bearings are provided on the spindle and feed screw. The general dimensions, capacity and weight of this machine are similar to No. 21, but the floor space required is 4 ft. x 21 ft., the increased length being due to the boring carriage. A detail in the design of these machines is the provision of a socket on the headstock to receive a crane mast for handling the shells.

OIL LEAKAGE FROM RING-LUBRICATED BEARINGS

THE leakage of oil from a ring-lubricated bearing may be due to several causes. Sometimes oil leaks through the horizontal keep joint of the bearing. The best remedy for this is to place a lead wire as packing in the joint. Bearings on large motors and generators often have a deep groove in the bottom half of the bearing, which groove, at both ends, communicates with the oil reservoir, and returns such oil as may have reached the joint by splashing out from the well through the motion of the lubricating rings.

Sometimes leakage will be observed along the shafting. It is important that there should be good clearance between the outer lip and the shaft, and if it is too close a fit it should be eased. If the oil still has a tendency to creep along the shaft, an oil-thrower can be made in halves and fitted on the shaft, or it may simply be a piece of steel wire bent round the shaft and clinched so that it will keep its position. Grooves in the bush will arrest the greater part of the oil, whilst the remainder is thrown off the collars. The keep may be fitted with an internal lip, which prevents oil splashing out through the joint.

Ring lubrication is very effective, as the oil is continuously lifted by the ring or the rings over the shaft, and finds its way into the oil-distributing groove, whence the film of oil between the shaft and the bearing is kept amply renewed. Care should be taken that the oil-carrying grooves are well rounded in the direction of rotation, to facilitate the entrance of the oil between the frictional surfaces.—T. C. Thomson.

Autogenous Welded Joints. — The strength of the joint produced by autogenous welding, it is pointed out in a paper on high temperature flames in metal working, has been a fruitful source of discussion in the application of the process, and many contentions have been advanced as to the necessity of welds of highest tensile strength. It was early found that 100 per cent. welds, or, in other words, those having a breaking strength equivalent to that of the metal itself, could be produced, but the sacrifice of elongation and reduction of area materially lessened the apparent value of such welds. Present practice is directed towards securing a weld of good tensile strength, as compared with the strength of the plate, with high ductility, since thereby the service conditions are better fulfilled. The growth in understanding of such requirements has resulted in the production of methods which, combined with proper apparatus, may uniformly produce these results.

THE SUPER-GAUGE

NOT the least of the innumerable engineering problems raised by the war has been the production of a sufficient number of precision gauges to enable munitions to be built to the degree of accuracy demanded by modern warfare and its weapons. To land a shell within a few yards of the intended spot when firing from a concealed battery miles to the rear leaves no room for inaccuracy. The whole of the equipment has to be of the very finest design and construction, and the complexity of those methods of warfare which permit gunners to destroy defences which they cannot even see, introduces innumerable opportunities for error, and, therefore, makes yet more remarkable the extraordinary accuracy actually achieved.

Accuracy, however, is not and can not be easily secured. To take only a single link in the chain of things and events connecting the reconnoitring aeroplane with the destruction of the enemy's works by indirect gunfire, we have in the shell itself a remarkable engineering production consisting in its simplest type of a number of component parts, yet so perfect in its components and in its whole that hundreds of thousands of rounds can be expended with certainty of obtaining the desired results, however the shells be distributed between a thousand guns. Were it not so, warfare as we know it would be impossible, and it is not pleasant to contemplate the possible results of any inaccuracy in production. At the best it could only result in expenditure of ammunition to no effect, at the worst it might cause destruction of our own troops, incapacitation of our guns (by jambing), and even the loss of a minor or major action.

Such possibilities are not pleasant to contemplate, and to the uninitiated it might seem that the worst could so easily happen. In producing shells by the million, at a rate never before attempted, can we be sure that that tiny fraction of error which would spell tragedy or disaster shall never creep in? We trust and believe that we can. On the one hand, we have our best engineering firms making (inter alia) gauges for shop use, and on the other hand, we have the National Physical Laboratory passing under the seal of its authority a vast family of "super-gauges" for use by inspectors of munitions. Surely nothing defective could escape the close-drawn meshes of this double screen. The responsibility resting on our enginers is indeed immense. It sobers one to think of it, but every human precaution is being taken, and if there are those who have been a little disheartened by the severity of requirements, let them remember that these requirements are literally essential. Engineering Review.

Lathe Centres, Their Design and Application Features

By H. G. Fogarty

The necessity of maintaining lathe centres in a state of suitable accuracy is not always appreciated to an extent which their importance justifies. Opportunities for the application of special types of centres are more frequent than is generally supposed, and while a small expenditure of time and material is necessary to make them, the increased accuracy of the work produced and other obvious advantages more than repay any small initial cost.

THE importance of keeping lathe centres in perfect condition is a fact which most mechanics realize and few put into actual practice. Accuracy in lathe work chiefly depends upon the accuracy of centres and upon the

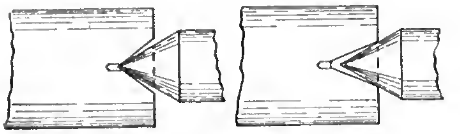


FIG. 1.

way in which the piece to be machined is centred.

Springing Shafts in Lathe

One of the most common practices which tends towards putting the centres in such a condition that they become practically useless for producing accurate work, is the use of the lathe for springing on straightening shafts. This practice is more or less common in repair shops but also exists in many seemingly well regulated manufacturing plants. The constant pounding and jarring which the lathe and lathe centres, chiefly the lathe, have to withstand under such treatment, and the damage from the same must indeed be evident to every mechanic. A lathe which is used as a straightening machine, can never be depended upon to turn out an accurate piece of work, for the chances are that the centres will be considerably out of alignment.

FIG. 2.

It must be admitted, however, that this manner of straightening shafts gives excellent results—as far as the shaft itself is concerned—but why use a good lathe for accomplishing this end? If the shaft is badly bent or kinked a straightening press, if one is available should be first used and the shaft then tried between centres. If it still requires straightening it should be put in an old lathe—which most shops boast of —and the necessary work done.

Heavy Cuts and Insufficient Lubrication of Centres

Another practice which proves costly to the centres, especially the dead centre, is allowing the shaft to run "dry," thus causing the centre to become cut and scored. The piece to be machined is generally put between centres, the dead centre having been first lubricated and brought up to bear with the desired pressure against the shaft. The lathe is now probably run at a high speed and a comparatively heavy cut taken, and before long it begins to "squeal." The cause of this is evident. The shaft becomes hot under the heavy cut and high speed and expands thus binding against the centres. The lathe should never be run while the centres are squealing. The tailstock should immediately be released and the centre again lubricated with either oil or red lead the latter giving excellent results.

Poor Centreing

Lathe centres are frequently put in a poor condition by the lack of common

FIG. 3.

sense when the work is being centred. The centre must be drilled to a sufficient depth to clear the point of the lathe centre, and should be countersunk or reamed to the exact angle. The standard angle for lathe centres is 60°. This insures a perfect bearing on all points of the centre. The poor bearing surface which is obtained when the centres are reamed either above or below the standard degree may be seen by referring to the accompanying sketch, Fig. 1.

Different Styles of Lathe Centres

It might be well to admit at first that the styles of lathe centres differ only in so much as the means of removing them from the spindle is concerned. Both the centre angle, which as was previously mentioned is 60°, and the spindle taper are standard. The taper used by the majority of lathe builders for their centres is the Morse standard. Among other standards, however, are the Brown and Sharp, the Reed, and the "Jarno" tapers; the taper ranges in these from about 0.6 inches to 0.625 inches per foot.

Removing the Centres

In order to remove the centres from the spindle some suitable means must be

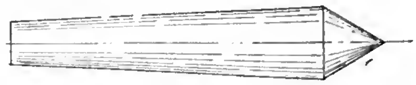


FIG. 4.

provided. As far as the dead centre is concerned it is usually removed by running the tailstock screw back to the limit thus forcing the centre out by means of the screw. In the headstock spindle, however, some other means must be employed. The old style of centre which had no means of being removed except by tapping it with a hammer or wrench until it became loose, has practically disappeared. This was a slow and expensive method at best, for the constant hammering on the centre had the tendency to gradually enlarge the hole in the spindle taper and put the centres out of alignment.

This old style of centre was followed by one which had a square or flat head, as shown in Fig. 2. This style is still used in many shops and it answers its purpose fairly well. To remove one of this style from the spindle, a wrench is placed on the square and by hitting the handle of the wrench a sharp blow, the centre becomes loosened and can be easily removed.

Still another style of centre is that shown in Fig. 3. This style is also used quite extensively, more especially on the older type of lathes. It is made as shown in the illustration, having the end turned down for a short distance back and threaded, the threads being about 16 or 18 per inch. A nut is fitted to this thread. To remove the centre all that is necessary is to screw the nut up against the spindle. This acts similarly to a small

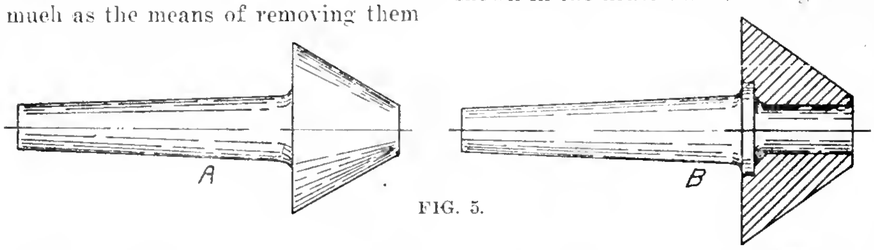


FIG. 5.

jack-screw, the tendency being to pull the centre out.

With the advent of the more modern lathes having a hollow spindle came the centre which is used now, most extensively. This is a plain centre as shown in Fig. 4, and to remove it all that is necessary is to insert a light bar into the back of the spindle and hit the centre a slight blow.

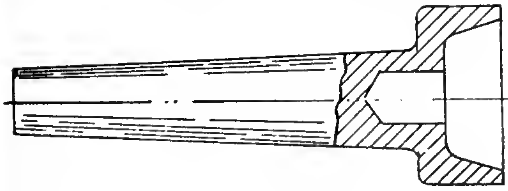


FIG. 6.

Special Centres

The centres which we have just referred to are all standard and are used only for straight or taper turning. Besides these there are several special centres in use but only a few of the more important will be mentioned here.

Pipe Centres

The pipe centre is one of the most common of these. It is often necessary on special jobs to turn or cut wrought iron pipe and if a plug has not been inserted in one end of the pipe a cone centre is used. Two other important styles of pipe centres are shown in Fig. 5. The one shown at A is turned from the solid; the angle of the bevel being about 60° for the smaller size of pipe, but for pipe of a large diameter a bevel angle ranging from 80° to 90° is advisable. As this style of centre is solid, the rough pipe end revolving on it soon cuts and scours it. The centre shown at B has proved itself most efficient for this particular line of work. The shank is made of steel and is turned down on the end to a suitable distance back leaving a sufficient shoulder or collar for the cone to bear against. The cone is usually made of cast iron and is bored to the size of the end of the shank, being a nice running fit. It might be stated that a fillet left in the shoulder of the flank would be more advisable than a sharp corner as it would insure a certain degree of strength to this part of the centre. When in use the cone revolves on the spindle with the pipe thus eliminating the cuts and scores which are common to the solid style of centre.

Special Centres for Drilling

The lathe is often used as a drilling machine, the drill chuck and drill being held in the chuck of the machine. In such a case a drill pad or centre as shown in Fig. 6 is used for holding the work. This centre needs no explanation, the hole being bored to any suitable size to take the work in hand.

Another style of drill centre is illustrated in Fig. 7. This centre is used chiefly for drilling holes through the cross section of a shaft or bar. To insure that the hole to be drilled will be in the direct centre of the piece considerable care must be taken in laying out the V so that its centre line will be exactly in line with the centre line of the shank.

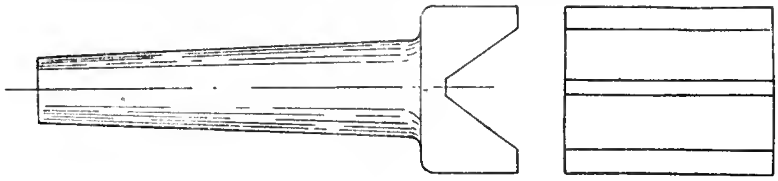


FIG. 7.

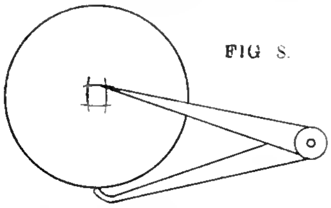


FIG 8.

Methods of Centreing

Probably the most common method employed in centreing shafts is by the use of calipers or more preferably the "haemaphrodites," which are made in the combined form of a caliper and divider. In using these the end of the shaft is first chalked so as to show the clear markings, and the calipers are set to a distance slightly greater than the distance to the centre of the shaft. Scratch marks are made from four points on the circumference, the appearance of the markings being similar to those shown in Fig. 8. The centre is easily located between these marks by means of a centre or prick punch. Centreing by means of a V block and surface gauge gives results similar to the methods just mentioned, but it is a practice that is not used in a great many instances. The V block is made as shown in the illustration Fig. 9, the base being planed to give a true bearing surface and the two Vs are machined in alignment with one another. The surface gauge and block with the shaft in place as shown, are placed on some level surface for instance the table of a planer and the end of the shaft is scratched as shown. The centre is then located by the same means as previously described.

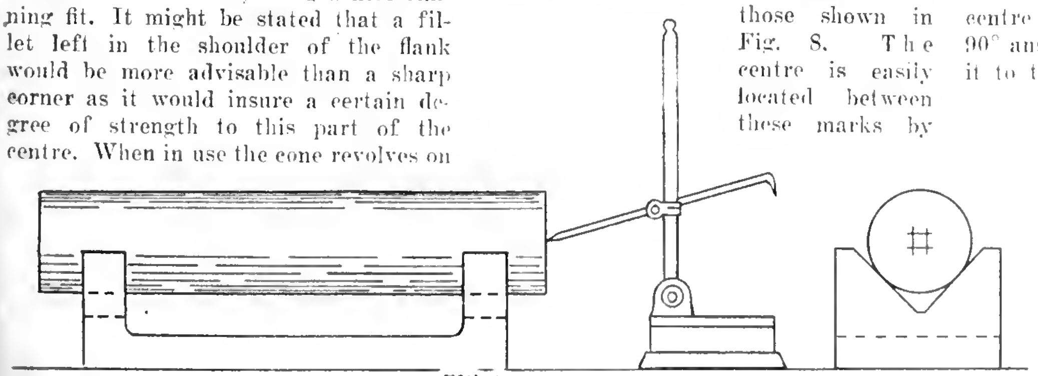


FIG 9.

Self-Centreing or Bell Punch

An excellent method of centreing is by means of the punch illustrated in Fig. 10. The cone is made of steel and is bored out, as shown, to a suitable bevel, preferably 60° to 70°. A hole is drilled through the centre of the bell casing, in which the centre punch slides. In using this punch all that is necessary is to place the bell or mouth over the end of the shaft and hit the centre punch a blow with a hammer. This gives an accurate centre providing care has been previously taken in holding the punch square with the work. If the punch was placed over the shaft in a tilted position as shown in sketch B, Fig. 10, the accuracy of the centre then marked could not be depended upon.

Centre Square

By the use of the centre square, which is included in every combination set, a method of centering either rounds or squares may be employed which is compelled to insure accuracy. No hesitation is necessary in saying that centreing by this method is the best and most economical in every respect. The body of the centre square as shown in Fig. 11, is a 90° angle and a slot is machined through it to take the sliding scale. The scale is made with a narrow slot cut along its entire length, which engages with a lug in the body of the square. By this means

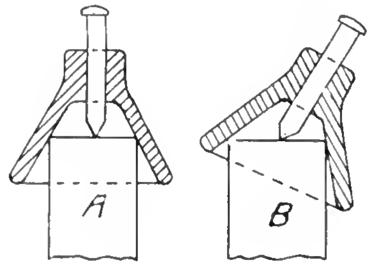


FIG. 10.

the scale can be adjusted to any length and is held in any desired position by tightening the knurl screw, which causes the lug to bind against the slot in the scale. All that is necessary in centreing with this tool is to hold the square over the end of the shaft as shown and describe a line. Move the square farther around on the circumference and discribe another line. The point where these two lines intersect being the exact centre of the shaft.

Lathe Centreing

There are several methods of centreing work in the lathe, the most common practice being by means of the square centre shown in Fig. 12. The square centre A, has a taper turned to fit the spindle of the tailstock. A hole is drilled through its entire length, one end of which is squared in order to take the tool which is made from ⅝ in. or ¾ in. square tool steel. This tool is ground to a 60° angle, and considerable clearance is given to the bottom side. This clearance enables the tool to enter the required distance. If the tool is ground otherwise, that is with very little clearance it would only be possible to mark the end of the shaft. This may be readily seen by referring to sketch D, Fig. 12.

In centreing by this method the shaft is first rough centred by means of a heavy centre punch. It is then put in the lathe between the centres, the square centre just described taking the place of the dead centre.

The tool illustrated at C, Fig. 12, is clamped in the tool post, the lathe carriage having been run back so that the fork will come opposite the end of the shaft to be centred. The shaft is then driven by means of the face plate and dog; the square centre is gradually fed in, while at the same time the tool post is fed across, the forked tool forcing against the end of the shaft till it runs perfectly true. The centre thus made is next drilled to the depth which will be sufficient to clear the point of the centre. The most suitable drill to use for this is the well known combination drill, which is made in several different sizes, the angle of the reamer being the required degree for the centre.

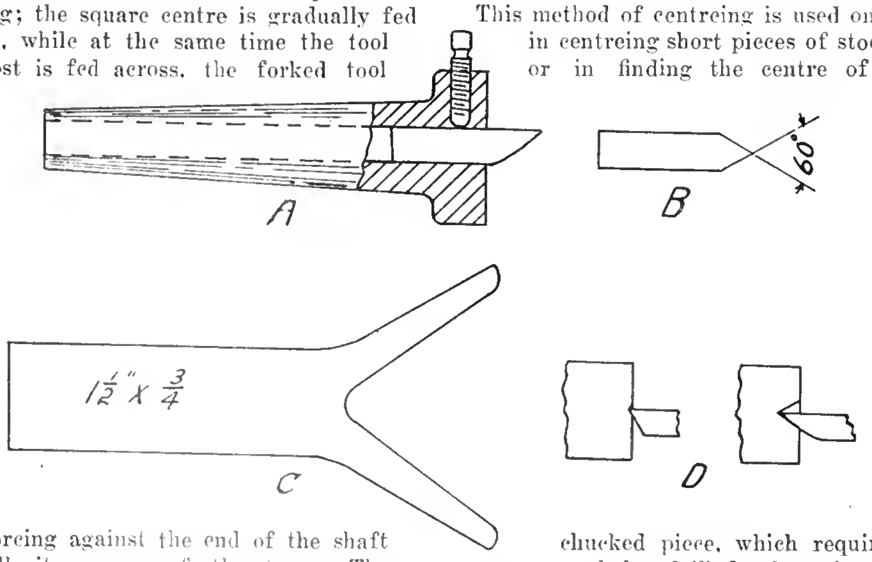


FIG. 12.

Chuck and Steady Rest

This method of centreing bars is also extensively used and is found to give entire satisfaction, especially when several pieces of the same size are to be centred. One end of the bar is chucked true, while the other end is held in the steady rest, the jaws of which are set centrally for the size of the bar. A combination drill is held in the tailstock spindle and this is fed into the stock, thus centreing it. In using this method a universal chuck is desirable, but either a three or four-jawed independent chuck may be used without the necessity of truing up each separate piece. By loosening one jaw in a three-jaw chuck, or two jaws in a four-jawed chuck, the work will be released and another one can be chucked in exactly the same position.

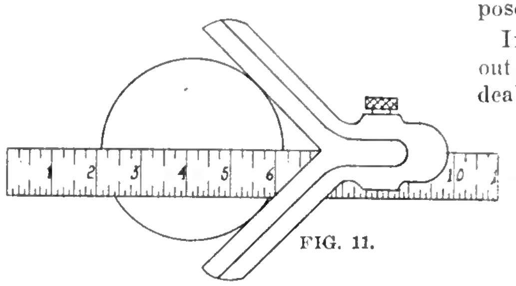
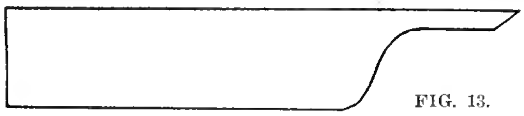


FIG. 11.

Spot Centreing

This method of centreing is used only in centreing short pieces of stock, or in finding the centre of a chucked piece, which requires a hole drilled through its centre. The tool for this purpose is illustrated in Fig. 13, care being taken to have suitable clearance back from the point and cutting edges of the tool. This tool is clamped in the tool post, being so adjusted that it comes in the exact centre line of the work, and in operation the lathe carriage is moved forward till the tool "spots" the centre. A slight pressure will force the point and cutting edges into the work, thus enabling a centre of sufficient depth for the purpose required to be made.

If the foregoing remarks are followed out there is no doubt but that a great deal of the trouble often encountered in securing perfect centreing will be eliminated, and as a result better and more accurate work will be turned out.



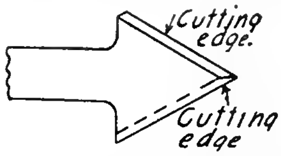


FIG. 13.

CONCERNING EXPLOSIVES

IN a paper by Professor Percy F. Frankland, read before the Birmingham Section of Chemical Industry, the author said:—"The disruptive properties of gun-cotton are greatly moderated by gelatinizing by means of solvents—acetone, acetic ester, alcohol, ether, etc.—and by mixing with nitro-glycerine ballistic materials like cordite and other smokeless powders are obtained.

There is still another class of explosives which combine great safety in handling with enormous disruptive effect—picric acid, discovered by Woulfe, of London, in 1771, but first used by the French under the name of 'Melinite' for filling shells in 1881, and later by the English under the name of 'Lyddite.' More recently this has been replaced by trinitrotoluene, first proposed by Haeussermann in 1891 for filling shells, and used by our service under the mark 'T.N.T.' It is even less sensitive to shock than picric acid. 'Ammonal,' used by the Austrians for shell-filling, is a mixture of 'T.N.T.' with ammonium nitrate, charcoal and aluminum powder. It is both very safe and very powerful. 'T.N.T.' is much used for demolishing bridges. It is so insensitive to shock that it is not exploded on being struck by a rifle bullet, and when in a shell it withstands the impact of the latter piercing an armour-plate.

"Tetra-nitro-aniline, obtained by Flurscheim, enjoys the unique position among explosives of having been discovered in Great Britain. It is said to be as safe as, and even more powerful than, trinitrotoluene."

The Algoma Steel Corporation, Sault Ste. Marie, Ont., is selling a quantity of electrical equipment formerly used as an auxiliary lighting plant.

Sheet Metal Elbows, Their Development and Laying Off-V.

By J. W. Ross

In order to thoroughly understand the principles involved in the development of cylindrical and other forms, such as are met in sheet metal work, a considerable knowledge of geometry is desirable. Through the medium of these articles, the author places practical examples at the disposal of our readers, and the knowledge to be gained by a close and persistent study of the principles and methods employed will well repay the time spent.

ELBOW AND OVAL-SHAPED CROSS-SECTION

FIG 24 shows elevation and cross-section plan views of a five-piece 90-degree elbow, the cross-section plan being shaped oval fashion, with two flat sides.

The elevation and mitre lines are drawn as in preceding problems. The

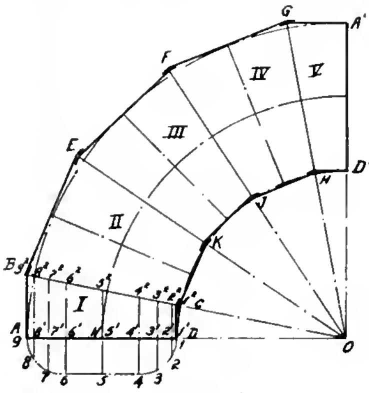


FIG. 24.

neutral diameter AD is equal to 24 inches and the radius OD to 27 inches. Divide AD into 4 equal parts as $6^15^14^1$. With 6^1 as centre and 6^1A as radius strike the neutral quadrant A6. Also with 4^1D as radius and 4^1 as centre draw the quadrant D^4. Draw the line 6 5 4 parallel to AD and tangent to the two quadrants. The half cross-section plan is shown by A654D. Divide the quadrants A6 and D4 each into the same number of equal parts, projecting these points—through and at right angles to AD—to the mitre line BC. Number all points in consecutive order and in relation to each intersecting line.

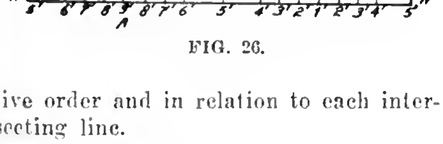


FIG. 26.

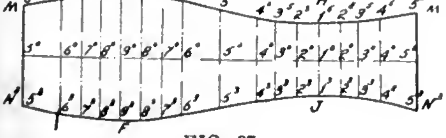


FIG. 27.

Twice the length of the flat side 6 5 4 added to the circumference of the circle obtained from its diameter by the combined radii of the two quadrants as $A6^1$ and $D4^1$ will equal the stretchout of the plate, which equals $(2\times12)+(12\times3.14)$ equals 24+37 11-16, equals 61 11-16 in. Measure 61 11-16 inches along the line $N5^1N$, Fig. 26. Bisect at 5^1. Measure off 5^16^1 and 5^14^1, Fig. 26 equal to 5 6 and 5 4, Fig. 24, which equals 6 inches each. Measure of 6^16^1 and 4^14^1, Fig. 26, each equal to the quarter circles 9 6 and 1 4, which is 9 27-64 inches. The end distances, 5^16^1 and 4^15^1, are then each equal to 6 inches. Divide 6^16^1 and 4^14^1, Fig. 26, each into twice the number of parts as in each quadrant 9 6 and 4 1, Fig. 24. Through these points erect perpendiculars, and number accordingly. Transfer the distances as 9^19^2, 8^18^2, etc., Fig. 24, over to their corresponding numbers on Fig. 26.

Fig. 26 shows the full pattern for courses I and V and the half pattern for course III, laps, etc., to be drawn in.

Courses II and IV are developed similarly to course W, Fig. 18, using the neutral diameter and cross-section similar to course I, Fig. 24. The stretchout for courses II and IV will be equal to 61 11-16 + 7 times the plate thickness for a slack fit. The pattern is shown in Fig. 27.

Elbow with Square Section

Fig. 28 shows the elevation and square section plan view of a 3-course 90-degree elbow. The neutral diameter AD equals 24 inches and DO 27 inches. The elevation and mitre lines are in the usual manner. $A^1D^1D^2A^2$ shows the plan view. The stretchout is equal to the sum of all the sides of the neutral section. Measure off D^1D^1. Fig. 29, equal to 4×24 inches, which equals 96 inches. Divide this into 4 equal spaces representing the 4 sides of the square. Erect perpendiculars through these points as shown by $D^1D^2A^2A^1D^1$, Fig. 29. Make D^1C, D^2C, Fig. 29, each equal to the length DC, Fig. 28. Also measure off A^1B, A^1B, Fig. 29, each equal to AB, Fig. 28. Connect these points with straight lines as shown in Fig. 29.

The templet without laps for courses I and III is shown in Fig. 29. Fig. 30 shows the pattern for course II and is self explanatory if the preceding problems have been thoroughly understood.

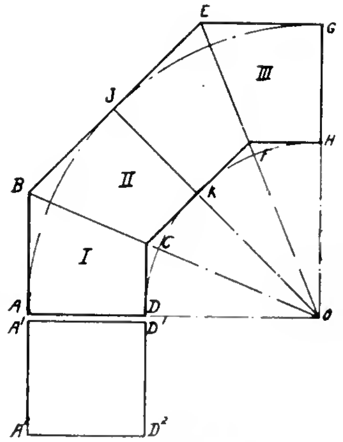


FIG. 28.

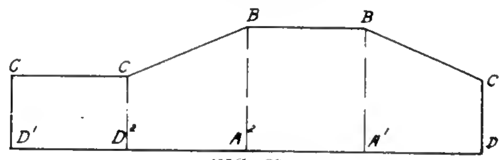


FIG. 29.

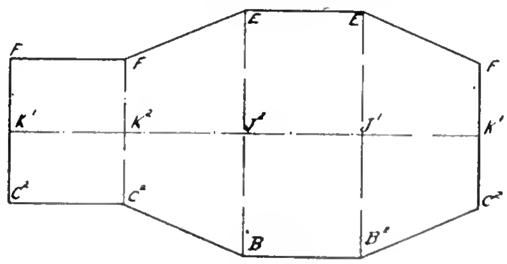


FIG. 30.

HARDENING HIGH-SPEED SCREW MACHINE TOOLS

By R. A. Mulholland*

NOW that the price of high-speed steel is soaring, it behooves the machine shops of the country to give serious thought to the conservation of their present supply. Much good steel is wasted every day through poor practice in heat treatment. A tool improperly hardened naturally has to be ground oftener than a properly hardened one, and the result is a serious loss in manufacturing time and a waste of perfectly good high-speed steel.

All the up-to-date methods may be practised in the hardening, and yet the tool may prove unsatisfactory when run at the speed and feed that high-speed

*Consulting Metallurgist, Indianapolis, Ind.

steel will stand when properly treated. Some of the most serious troubles have been experienced in the hardening of screw machine tools, such as special shaped cutting-off tools, box-turning tools and facing tools—in fact, any tool that is ground from the annealed bars as they are received from the mill, and have one of the cutting edges on one of the sides of the annealed bar. Especially is this true of the box-turning tool where generally little or nothing is ground from the face of the tool stock. Most of these tools are made from ½ x 1 in. stock, and require no forging before they are ground on the emery wheel.

The practice of making stock-removing screw machine tools should not differ in any essential from the making of taps and the more delicate tools that are made in the tool room. What competent tool-maker would think of making an expensive tool from a piece of stock that was just large enough to "clean up?" Did you ever stop to consider why the experienced tool-maker always turns off at least 5 per cent. of the diameter before attempting to make a tool that must have an enduring cutting edge? The theory is the same for large and small tools. The reason is that the annealed bars as received from the mill have a thin shell of decarbonized scale, so to speak, on the outside. This decarbonized area must be removed before a good cutting edge can be secured that will harden satisfactorily.

A simple method for doing this is to grind the tool to its approximate shape, and then put it in the milling machine and remove about 5 per cent. of the thickness of the stock from the surface that is to be the cutting edge. If this is done, when the tool is properly hardened it will have its maximum cutting capacity and will run longer on fewer grindings than will the tool made from the rough stock without first removing the decarbonized area. The practice of disregarding the decarbonized area in all forms of tool steel has always been and always will be a great source of loss both in the efficiency of the tool and the cause of excessive tool steel bills.

The actual hardening of high-speed steel is a comparatively simple matter, and if the tool is properly prepared for hardening there is little doubt that the result will be better than the average shop is now obtaining from the careless way that high-speed screw machine tools are made in a large number of plants.—Iron Age.

MANGANESE BRONZE

LARGE quantities of non-ferrous scrap must accumulate from time to time, and the problem of its economic disposal is of interest. The methods used at the Washington Navy Yard were recently described in a paper before the American Society of Naval Engineers by Lieut. J. B. Rhodes, U. S. Navy, dealing particularly with manganese bronze. The following materials were available, with the compositions approximately as shown:

1.—Naval brass: Copper, 62 per cent.; zinc, 37 per cent.; tin, 1 per cent.

2. Cartridge-case metal: Copper, 68 per cent.; zinc, 31.6 per cent.; nickel, 0.4 per cent.

3.—Manganese bronze: Copper, 59 per cent.; zinc, 41 per cent.

4.—Commercial brass can be used in small quantities, but should be avoided, as the lead content is too high.

The results of experiments during about six months have shown that it is practicable to make high-grade ingots in an oil-fired "Rockwell" furnace of about two tons capacity. This has been accomplished in spite of the well-known prejudice against open-flame furnaces in the manufacture of non-ferrous alloys. Oxidation has been reduced to a very small amount by using wood scraps from pattern shop, and salt. The bath is protected by the molten salt, and the wood ensures a reducing rather than an oxidizing atmosphere in the furnace.

In undertaking the manufacture of manganese bronze a special hardener is first made, and is regarded as the secret of the whole process. A satisfactory mix consists of 100 lb. copper, 25 lb. mild steel, 25 lb. of 80 per cent. ferro-manganese, made by melting the steel and alloy together, and then adding the copper as quickly as the melt will take it.

In using the scrap it is necessary to know the approximate analysis. The desired composition is:

	Per cent.
Copper	57.0
Zinc	40.0
Iron	1.0
Manganese	0.75
Aluminum	0.75
Tin	0.50

The usual losses in zinc, manganese, aluminum, and tin are allowed for, and a heat melted and cast. After analysis, the final adjustments are calculated and allowed for (particularly zinc, which must be 41 per cent. in the finished casting) when re-melting for use in the finished casting.

In melting in the oil furnace, the most difficult scrap to melt should be charged first, although all but finals may be charged at once. As soon as melted, the hardener should be added. In about half an hour, charge the remaining scrap (if charge is not made all at the same time) and continue the melt. After the heat is well up, add zinc, then tin (if necessary), and finally aluminum; stir well and tap. Small ladles are used for pouring the ingots. Ingots are numbered to show the heat, and turned into the store awaiting analysis. The cost of the method is high, on account of the labor in pouring and marking ingots, but, counting in furnace loss, labor, fuel, and upkeep of furnace it is less than 2 cents per lb., so that scrap worth 7½ cents per lb. can be converted into manganese bronze to cost not over 10 cents per lb.

One of the heats gave 82,000 lb. tensile strength, and 28 per cent. elongation. Quite frequently 75,000 lb. tensile strength and 20 per cent. elongation are obtained in sand castings. If high pouring temperatures are avoided and the metal is poured when it ceases to give off zinc fumes in large volume, excellent values will be obtained so long as the zinc content is kept at 41 per cent.

PLATING ALUMINUM WITH NICKEL

AN apparently successful method of plating aluminum with nickel is described in a recent number of the Bulletin de la Societe d'Encouragement pour l'Industrie Nationale, by J. Canac and E. Tassilly. The process permits the direct deposition of nickel on aluminum in an adherent form. The metal is cleaned by passing it through a bath of boiling potash and then scrubbed with milk of lime. After soaking in a bath of 0.2 per cent. potassium cyanide for several minutes, it is submitted to the action of an iron-hydrochloric acid bath. 500 parts HCl, 500 part H_2O and one part iron, until the metal takes on a certain appearance described as metallic "watering." It is washed with water after each of these operations.

The formula found satisfactory for nickel plating is:—Water, 1,000 cu.c.; nickel chloride, 50 grams; boric acid, 20 grams. The current is 1 amp. at 2½ volts. The plated metal is said to have a pleasing soft gray appearance, easily taking a metallic luster when polished with a wire brush, the plating being remarkably adherent. It is claimed to endure hammering and to bend in sheet form without cracking. The metal, as cleaned in the iron-acid bath, shows under the microscope a surface full of minute cavities in which the nickel deposits and adheres.

Quarter Turn Drive.—We are advised by F. Reddaway & Co., Montreal, that for the "Quarter Turn Drive," described and illustrated on page 366, October 14 issue of Canadian Machinery, a "Camel Hair" belt is employed. They further state that an 8-inch belt of same brand takes care of the crossed drive of a heavy planer in the same plant.

PROGRESS IN NEW EQUIPMENT

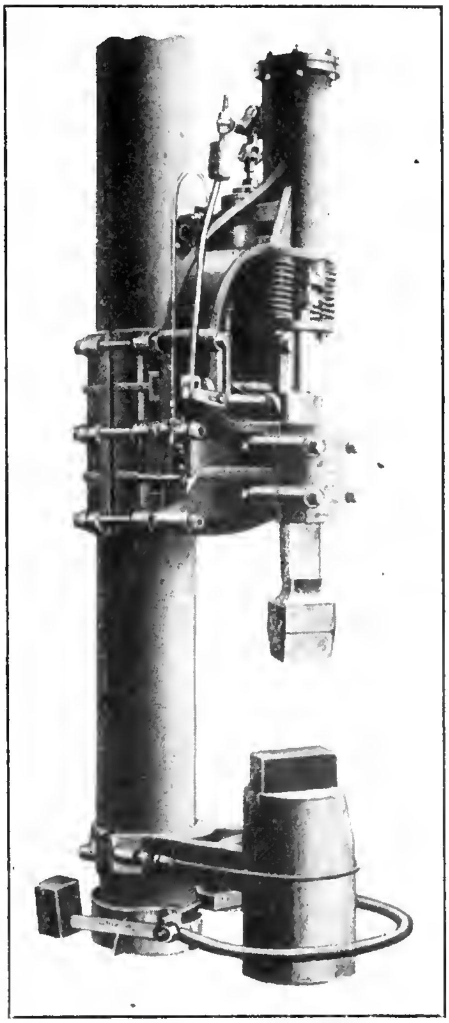
A Record of New and Improved Machinery and Accessories for the Machine, Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

IMPROVED TYPE POST HAMMER

THE Q.M.S. Co. have placed upon the market an improved type post hammer, as illustrated in the accompanying photograph. The extremely high price of tool steel makes it a valuable adjunct to any machine shop equipment. Short pieces of tool steel, which were formerly scrapped, can be drawn down and used for small lathe tools and in tool holders.

This hammer is particularly adapted for all classes of light forging and can be easily handled by a blacksmith, doing away with the necessity of a helper. The machine can be operated by steam or compressed air. A patented valve movement insures perfect control. If treadle is brought down to the limit, the ram will give a hard, full blow, the same as a drop hammer; or the treadle can be pressed down part way, when the ram will give repeated hard or light blows, as may be required. The change from one kind of blow to another is made instantly and smoothly.

The Vulcan Engineering Sales Co., Chicago, are distributors of this product.



IMPROVED TYPE POST HAMMER.

RAIL ENDING MACHINE

THE accompanying illustrations show a recent design of rail-ending machine for operating on the high carbon, high manganese, open-hearth rails, as made to-day.

The general outline of the machine, which is produced by the Newton Machine Tool Works, Inc., Philadelphia, Pa., closely follows preceding designs, with improvements in details of construction to provide for the high resistance encountered on the material referred to.

The motor is mounted on the top of the machine and drives through a ten-inch wide belt through phosphor bronze worm wheel and hardened steel worm of steep lead, the worm wheel being double-keyed to the spindle. The spindle is one-half the diameter of the cutter head; thus giving a sense of proportion which would not be obtained by quoting figures.

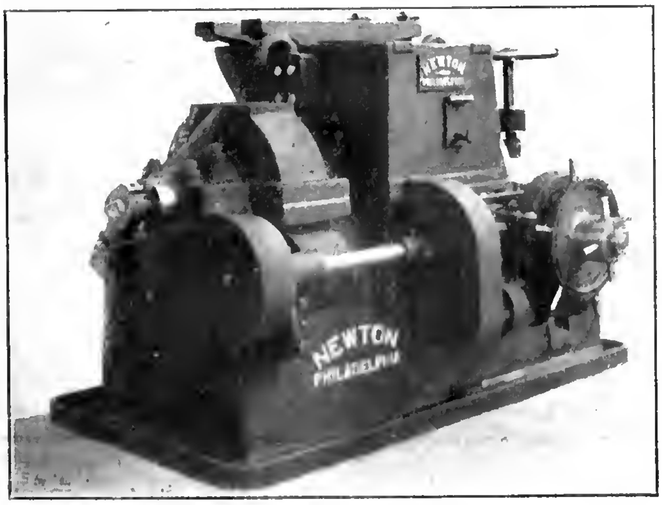
Bearings are capped and bronze bushed, so that compensation for wear is provided.

Feed is by stationary screw and revolving nut, thrust-bearing taken by enclosed ball bearings eight inches in diameter.

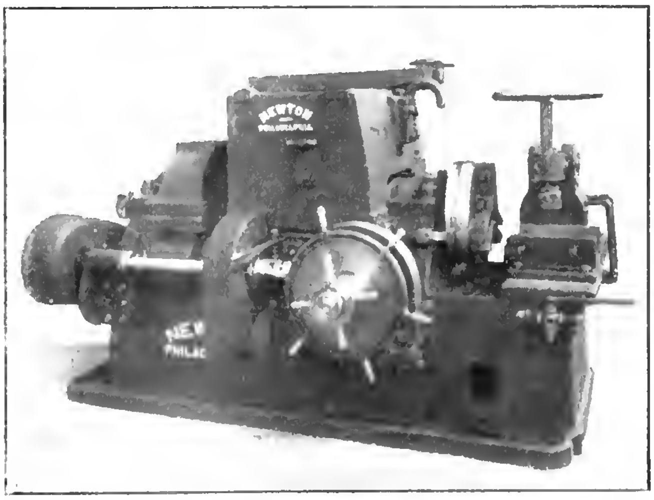
The spindle has a movement of $2\frac{3}{4}$ in. forward movement, having hand adjustment and four changes of feed amounting to 1/64-1/32-3/64-1/16 of an inch per revolution, the revolutions of the cutter head being from five to fifteen per minute. In addition, the spindle has adjustable automatic stop, with safety limits, so that spindle cannot jam at either end, and is also furnished with power quick return motion. All gears are fully enclosed and principal driving and feed gears run in oil.

The base is surrounded by the pan, and a circulating pump and distribution system for cooling the tools is provided. This includes cored openings in the base, which provides for the ready removal of chips. Lifting hooks are fitted so that the machine can be readily transported from one position to another to take care of the different lengths of rails encountered in the mill.

Cutter head is of the three-tool type, and can be used either with solid cutters or with tool-holders. Rails are clamped in a chuck, fitted with hardened serrated plates, the mouth of chuck be-



NEW DESIGN RAIL-ENDING MACHINE.



NEW DESIGN RAIL-ENDING MACHINE.

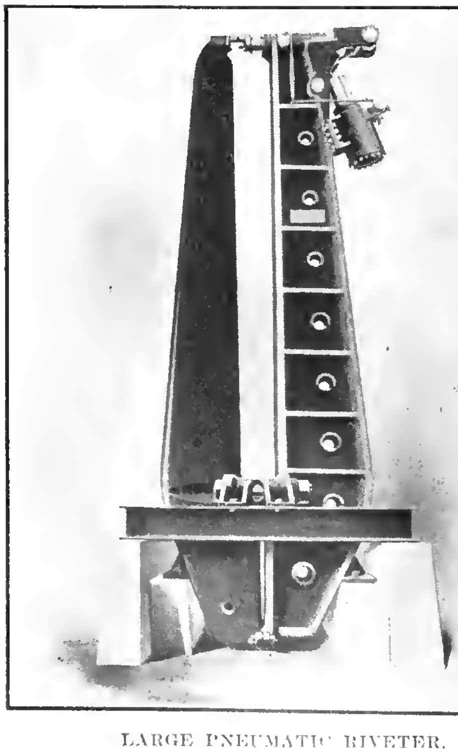
ing bevelled in all directions to provide for the ready entrance of rail. The clamp is of a patented clearance air-operated type, providing a clamping pressure of 32 tons, operation being by valve shown in the foreground of photograph. Adjusting screw on the air clamp is provided with hand wheel to take care of the various sections of rail placed in the machine.

These machines work in conjunction with machines for drilling splice bar holes, and in developing this machine the aim has been to produce a machine with a capacity on tee head rails in excess of that of the drilling machine.

LARGE PNEUMATIC RIVETER

THERE have recently been built by the Hanna Engineering Works, Chicago, what are believed to be two of the largest pneumatic riveters in existence. Each machine has a reach of 21 ft., and is capable of exerting a pressure of 100 tons on the rivet die at 100 pounds air pressure. An idea as to its size can be obtained when the weight of 40 tons is considered.

In this riveter, have been combined in a simple form, toggles, levers and guide links to give the large opening of the toggle joint movement with its gradually increasing pressure until the desired pressure is reached, and a simple lever movement throughout a considerable space under approximately maximum pressure. This space is sufficient so that there need be no uncertainty about the pressure applied on rivet; and the machine once adjusted for a certain length of rivet and thickness of plate, will require no further adjustment for ordinary variations in length of rivets, size of holes, or thickness of plates, thus producing hydraulic results with a pneumatic riveter.



LARGE PNEUMATIC RIVETER.

These heavy duty riveters are furnished with cylinders having 22 inches of piston stroke with a relative travel of 5¾ in. of the rivet die. As in the smaller machines, the toggle action takes place during the first half of piston travel, that is 11 inches, which represents approximately the first 4¾ in. of die travel. At this point the mechanism automatically changes into a simple lever action, without a critical point, thus producing the rated tonnage of the machine at the rivet die, and practically uniform for the last inch of the die travel.

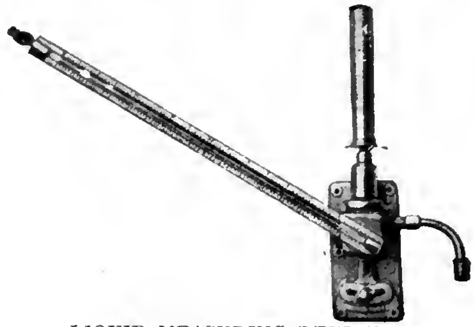
By the use of an inexpensive pressure regulating valve in the air supply line to riveter, the pressure of air at the cylinder can be quickly changed to vary the pressure on the rivet dies to produce any tonnage the operator may deem advisable for any size of rivet he may wish to drive.

This is a large machine and marks a new era in the riveting world. The Vulcan Engineering Sales Co., Chicago, are placing these riveters on the market.

LIQUID MEASURING DEVICE

A NEW measuring instrument for indicating the quantity of liquid contained in tanks and similar storage receptacles is now being placed on the market. The device operates on what might be termed a hydro-pneumatic principle, and its successful adaptation to industrial requirements will enable the abandonment of floats, gauge glasses, and similar mechanical devices which are not always satisfactory from the point of accuracy, reliability, ease of observation, etc.

Stancliffe's patent liquid measuring device operates through the medium of a metal tube, one end of which is immersed to the full depth of the liquid, and the other end connected to the instrument. The instrument consists of a small pot or vessel containing mercury, thus causing it to ascend a suitably arranged scale according to the degree of pressure. The tube from the mercury chamber to the storage tank is connected above the level of the mercury, so that the air pressure passes through the connecting tube to the bottom of the liquid, where it escapes. The pressure at which this happens is proportional to the height or head of liquid above the bottom of the tube. Consequently as the air pressure varies with the head of liquid, the mercury column supported by the air pressure will vary correspondingly. The pressure at which the air escapes is determined by the mercury



LIQUID MEASURING DEVICE.

refusing to rise further into the scale tube. This tube is graduated to suit the specific gravity of the liquid being measured.

It is obvious that this instrument can be placed above or below, or at any distance from the liquid to be measured, and as the connecting pipe contains air only, it is not affected by frost.

The patents in connection with the device are controlled by the Universal Liquid Measuring Devices, Ltd., 125 Isabella Street, Toronto, Ont.

ELECTRICITY FROM BELT SLIP

THAT the unavoidable slight slip of all running belts on their pulleys produces static charges of electricity in these two bodies has often been remarked, and it has sometimes been suggested that this has been the cause of mysterious explosions in powder works. Interest, therefore, attaches to a simple device for removing this charge, described by W. T. Estlick, in the Electrical Review and Western Electrician.

It was used in a textile mill where cotton looms were running with rubber work, so that it was necessary to keep the room perfectly dry. These conditions caused the accumulation of large charges of electricity in the belts of the motors driving the looms, with the result that the belts attracted all the particles of lint floating about, eventually shaking them on to the yarn and making the work dirty. The bits of lint would also gather in the motor, and when this was blown out would settle on the work.

On two occasions also a squirrel-cage motor burnt out, apparently from no other cause than that of the charge in the rotor discharging to earth by sparkling across on to the stator winding and puncturing the insulation. Copper strips connected to earth were then placed above and below the belt, brushing lightly against it. After this no more burning out occurred, and the collection of the particles of lint was also prevented.

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SLANDERING OUR SHELL MANUFACTURERS

WITHIN the past few weeks, attempt has been made to discredit the success achieved by Canadian manufacturers of munitions. Information reached us that American manufacturers of machine tools and other equipment were being zealously plied with tales of the tremendous losses being suffered by Canadian shell producers, on account of the unprecedented number of rejections which the Imperial Government had found to be necessary. Since the war started, it has become quite proper to speak in millions—it is so much more impressive. Naturally, then, a million rejected shells of one firm's manufacture made a ready weapon for the detractors of our operative and administrative staffs.

We have taken some pains to prove the truth of the assertion or uncover its falseness, and are now in a position to say authoritatively that there is absolutely no foundation for the statement.

The evident intent of spreading broadcast among American manufacturers the tale that one Canadian firm of itself had a million shell rejections was to create distrust regarding payments for machine tool equipment supplied or on order, and incidentally to hamper not only the maintenance of the production standard we have already attained, but offset further progress and development.

Most people have the impression that shell manufacture as prosecuted in Canada is a profitable undertaking, the suggestion of bankruptcy which the rejection of a million shells portends savors therefore more or less of grim humor.

THE COMMERCIAL PROSPECTS OF NEUTRALS

THAT efforts to skim the cream of European business after the war will be made by all parties capable of doing so, goes without saying, but just how far European nations in general and the Allies in particular will submit to this process is a matter which will be settled by the European nations themselves.

The resumption of ordinary commercial production by our manufacturers will be accelerated according to the rate at which material and labor return to their former basis. That such return will be gradual and perhaps prolonged is more than probable, consequently a considerable proportion of Canada's industrial activity will be available for use in the rebuilding of Europe.

The recent action of the Central States in abolishing the tariff between Germany and Austria will not be overlooked by the British Empire and its associates, and the present union of nations which has been consecrated with the blood of the proudest and best of their manhood may well be expected to have a strength and closeness which will be proof against unlimited exploitation.

In these days it is deeds, not words that count, and if the deeds of powerful neutrals are limited to the laying of plans whereby they may profit from the misfortunes of others, we may rest assured that the plans will meet with just such success as they deserve, no more and no less.

Nations which are able and willing to fight for the rights and liberty of weaker nations are more than likely to see that the credit, thanks and opportunities offered in return are duly received by the proper parties.

The recently announced organization of leading business men in New York for the express purpose of capturing trade after the war seems rather like a case of the wish being father to the thought. That the Allies will be in a state of exhaustion after the war, is without doubt, but that they will allow an onlooker to approach from a place of safety and offer help at a price after the danger has been averted, is most unlikely.

Current events prove that anything worth having must be fought for, and neutrals who anticipate prosperous times as the result of other people's misfortunes may find their overtures appraised at their true value, and received just for so long as they may be acceptable to the parties concerned.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey forge, Pittsburgh	$16 95	
Lake Superior, charcoal, Chicago	17 75	
Ferro nickel pig iron (Soo)	25 00	
	Montreal.	**Toronto.**
Middlesboro, No. 3	$24 00	.....
Carron, special	25 00	.....
Carron, soft	25 00	.....
Cleveland, No. 3	24 00	.....
Clarence, No. 3	24 50	.....
Glengarnock	28 00	.....
Summerlee, No. 1	30 00	.....
Summerlee, No. 3	29 00	.....
Michigan charcoal iron.	28 00	.....
Victoria, No. 1	24 00	23 00
Victoria, No. 2X	23 00	23 00
Victoria, No. 2 plain	23 00	23 00
Hamilton, No. 1	23 00	23 00
Hamilton, No. 2	23 00	23 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	2.50
Steel bars, f.o.b., Toronto	2.75
Common bar iron, f.o.b., Montreal	2.50
Steel bars, f.o.b., Montreal	2.75
Twisted reinforcing bars	2.55
Bessemer rails, heavy, at mill	1.25
Steel bars, Pittsburgh	...
Tank plates, Pittsburgh	...
Beams and angles, Pittsburgh	...
Steel hoops, Pittsburgh	
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.75
Small shapes	2.75
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	2.20
Structural shapes	2.30
Plates	2.30

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal	Toronto
Plates, ¼ to ½ in., 100 lb.	$2 75	$2 50
Heads, per 100 lb.	3 00	2 75
Tank plates, 3-16 in.	3 00	2 80

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$13 75	$12 75
Copper, crucible	16 25	15 00
Copper, unch-bled, heavy	15 75	14 50
Copper, wire, unch-bled	15 75	14 50
No. 1 machine compos'n	12 00	11 75
No. 1 compos'n turnings	11 00	10 00
No. 1 wrought iron	10 00	10 00
Heavy melting steel	9 00	9 00
No. 1 machin'y cast iron	13 50	13 00
New brass clippings	11 50	11 00
No. 1 brass turnings	9 50	9 00
Aluminum	27 00	27 00
Heavy lead	5 25	5 00
Tea lead	$ 4 25	$ 4 00
Scrap zinc	12 75	12 00

W. I. PIPE DISCOUNTS.

Following are Toronto jobbers' discounts on pipe in effect Nov. 5, 1915:

	Buttweld Black	Gal.	Lapweld Black	Gal.
Standard				
¼, ⅜ in.	62	38½	....	....
½ in.	67	47½	....	....
¾ to 1½ in.	72	52¼	....	....
2 in.	72	52½	68	48½
2½ to 4 in.	72	52½	71	51½
4½, 5, 6 in.	....	....	69	49½
7, 8, 10 in.	....	....	66	44½
X Strong P. E.				
¼, ⅜ in	55	38½	....	....
½ in	62	45½	....	....
¾ to 1½ in.	66	49½	....	....
2, 2½, 3 in.	67	50½	....	....
2 in.	....	....	62	45½
2½ to 4 in	....	....	65	48½
4½, 5, 6 in.	....	....	65	48½
7, 8 in	....	....	58	39½
XX Strong P. E.				
½ to 2 in	43	26½	....	....
2½ to 6 in.	....	....	42	25½
7 to 8 in.	....	....	39	20½
Genuine Wrot Iron.				
⅜ in	56	32½	....	....
½ in	61	41½	....	....
¾ to 1½ in.	66	46½	....	....
2 in.	66	46½	62	42½
2½, 3 in.	66	46½	65	45½
3½, 4 in.	....	....	65	45½
4½, 5, 6 in.	....	....	62	42½
7, 8 in.	....	....	59	37½

Wrought Nipples.

4 in. and under	77½%
4½ in. and larger	72%
4 in. and under, running thread.	57½%
Standard Couplings.	
4 in. and under	60%
4½ in. and larger	40%

MILLED PRODUCTS.

Sq. & Hex Head Cap Screws	65 & 5%
Sq. Head Set Screws	70 & 5%
Rd. & Fil. Head Cap Screws	45%
Flat & But. Head Cap Screws	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in.	70%
Semi-Fin. Nuts up to 1 in.	70%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

METALS.

	Montreal.	Toronto.
Lake Copper, carload	$21 50	$20 75
Electrolytic copper	21 25	20 50
Castings, copper	21 00	20 50
Tin	45 00	45 00
Spelter	20 00	20 00
Lead	6 75	7 00
Antimony	42 00	40 00
Aluminum	65 00	65 00

Prices per 100 lbs.

BILLETS.

	Per Gross Ton
Bessemer billets, Pittsburgh	$29 00
Open-hearth billets, Pittsburgh	30 00
Forging billets, Pittsburgh	52 00
Wire rods, Pittsburgh	38 00

NAILS AND SPIKES.

Standard steel wire nails, base	$2 80	$2 85
Cut nails	2 90	2 90
Miscellaneous wire nails	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	3 25	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	60 and 5
Stove bolts	82½
Plate washers	40
Machine bolts, ⅜ and less	65
Machine bolts, 7-16 and over	50
Blank bolts	50-7½
Bolt ends	50-7½
Machine screws, iron, brass	35
Nuts, square, all sizes	3¾c per lb off
Nuts, hexagon, all sizes	4¼c per lb. off
Iron rivets	67½
Boiler rivets, base, ¾-in. and larger	$3.75
Structural rivets, as above	3.75
Wood screws, flathead, bright	85, 10, 10 p.c. off
Wood screws, flathead, brass	67½ p.c. off
Wood screws, flathead, bronze	60 p.c. off

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong. Sizes Ins.	Price per ft.	D. Ex. Strong. Size Ins.	Price per ft.
⅛in	$.05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1¼in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	....
7 in	2.38	7 in	3.81	....	....
8 in	2.50	8 in	4.34	....	....
8 in	2.88	9 in	4.90	....	....
9 in	3.45	10 in	5.48	....	....
10 in.	3.20	....	....	....	....
10 in.	3.50	....	....	....	....
10 in.	4.12	....	....	....	....

COKE AND COAL

Solvay Foundry Coke	$6.25
Connellsville Foundry Coke	5.65
Yough Steam Lump Coal	3.63
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

COLD DRAWN STEEL SHAFTING.

At mill	25%
At warehouse	20%

Discounts off new list. Warehouse price at Montreal and Toronto.

MISCELLANEOUS

Solder, half-and-half	0.24
Putty, 100-lb. drums	2.70
Red dry lead, 100-lb. kegs, per cwt.	9.65
Glue, French medal, per lb.	0.15
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.25½
Benzine, single bbls., per gal.	0.25
Pure turpentine, single bbls.	0.85
Linseed oil, raw, single bbls.	0.85
Linseed oil, boiled, single bbls.	0.88
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.50
Lead Wool, per lb.	0.11
Pure Manila rope	0.16
Transmission rope, Manila	0.20
Drilling cables, Manila	0.17
Lard oil, per gal	0.73
Union thread cutting oil	0.60
Imperial quenching oil	0.35

POLISHING DRILL ROD

Discount off list, Montreal and Toronto 40%

PROOF COIL CHAIN.

¼ in.	$9.00
5-16 in.	5.90
⅜ in.	4.95
7-16 in.	4.55
½ in.	4.00
9-16 in.	4.20
⅝ in.	4.10
¾ in.	3.95
⅞ in.	3.80
1 inch	3.70

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	55
Carbon over 1½ in.	25
High Speed	
Blacksmith	55
Bit Stock	60 and 5
Centre drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Centre	25
Pipe Reamers	80

Discounts off standard list.

IRON PIPE FITTINGS.

Canadian malleable, A, 25 per cent.; B and C, 35 per cent.; cast iron, 60; standard bushings, 60 per cent.; headers, 60; flanged unions, 60; malleable bushings, 60; nipples, 75; malleable, lipped unions, 65.

TAPES

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3.50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$3 50	$3 50
Canada plates, dull, 52 sheets	3 25	3 25
Canada Plates, all bright	4 60	4 75
Apollo brand, 10¾ oz. galvanized	5 50	5 50
Queen's Head, 28 B.W.G.	6 00	6 00
Fleur-de-Lis, 28 B. W. G.	5 75	5 75
Gorbal's Best, No. 28	6 10	6 10
Viking metal, No. 28	5 25	5 25
Colborne Crown, No. 28	5 70	5 80
Premier No. 28	5 40	5 50
Premier, 10¾ oz.	....	5 75

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$14 25	.....
1¼ in.	15 00	.....
1½ in.	15 00	.....
1¾ in.	15 00	.....
2 in.	15 00	10 00
2¼ in.	16 50	11 00
2½ in.	17 50	12 85
3 in.	25 00	13 20
3½ in.	28 00	16 25
4 in.	33 00	20 75

Prices per 100 feet, Montreal and Toronto.

WASTE.

WHITE.	Cents per lb.
XXX Extra	0 11½
X Grand	0 11
XLCR	0 10¼
X Empire	0 09½
X Press	0 08¾
COLORED.	
Lion	0 07¾
Standard	0 07
Popular	0 06¼
Keen	0 05½
WOOL PACKING.	
Arrow	0 17
Axle	0 12
Anvil	0 09
Anchor	0 07
WASHED WIPERS.	
Select White	0 08½
Mixed Colored	0 06¼
Dark Colored	0 05¼

This list subject to trade discount for quantity.

BELTING RUBBER

Standard	50%
Best grades	30%

BELTING—NO. 1 OAK TANNED.

Extra heavy, single and d'ble, 40 & 10%	
Standard	50%
Cut leather lacing, No. 1	$1.20
Leather in sides	1.10

ELECTRIC WELD COIL CHAIN B.B.

⅛ in.	$12.75
3-16 in.	8.85
¼ in.	6.15
5-16 in.	4.90
⅜ in.	4.05
7-16 in.	3.85
½ in.	3.75
⅝ in.	3.60
¾ in.	3.60

Prices per 100 lbs.

PLATING CHEMICALS

Acid, boracic	$ .15
Acid, hydrochloric	.05
Acid, hydrofluoric	.06
Acid, nitric	.10
Acid, sulphuric	.05
Ammonia, aqua	.08
Ammonium carbonate	.15
Ammonium chloride	.11
Ammonium hydrosulphuret	.35
Ammonium sulphate	.07
Arsenic, white	.10
Copper sulphate	.10
Cobalt sulphate	.50
Iron perchloride	.20
Lead acetate	.16
Nickel ammonium sulphate	.10
Nickel carbonate	.50
Nickel sulphate	.15
Potassium carbonate	.40
Potassium sulphide (substitute)	.20
Silver chloride (per oz.)	.65
Silver nitrate (per oz.)	.45
Sodium bisulphite	.10
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.35
Sodium hydrate	.04
Sodium hyposulphite (per 100 lbs.)	3.00
Sodium phosphate	.14
Tin chloride	.45
Zinc chloride	.20
Zinc sulphate	.07

Prices Per Lb. Unless Otherwise Stated.

ANODES

Nickel	.47 to .52
Cobalt	1.75 to 2.00
Copper	.22 to .25
Tin	.45 to .50
Silver	.55 to .60
Zinc	.22 to .25

Prices Per Lb.

PLATING SUPPLIES

Polishing wheels, felt	1.50 to 1.75
Polishing wheels, bullneck	.80
Emery in kegs	.4½ to .06
Pumice, ground	.05
Emery glue	.15 to .20
Tripoli composition	.04 to .06
Crocus composition	.04 to .06
Emery composition	.05 to .07
Rouge, silver	.25 to .50
Rouge, nickel and brass	.15 to .25

Prices Per Lb.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents

Montreal, Que., Dec. 6, 1915.—General conditions are unchanged and the improved situation still continues. Shell-making industries are still very busy and the preparation of plant and equipment for the production of the heavier shells is nearing the stage when machining operations will be in progress. Added to the former duties of the old Shell Committee, the distribution of orders for the other allies may be placed in the hands of the newly organized Munitions Committee. This continent, and particularly Canada, is now more than ever placing herself among the older nations of the world in the supplying of necessities for foreign consumption. That we will retain our position following the war is generally conceded, but to maintain this place which present circumstances have almost forced upon us, there must needs be no cessation of effort. The cessation of hostilities is sure to usher in an era of prosperity and we must be prepared to take our proper place in the re-constructed distribution of trade between the Eastern and Western hemispheres.

Many lines of activity have been opened to Canadian manufacturers which a year or two ago were almost unknown. The chemical industry has been revolutionized in the past year and remarkable strides are being taken in the production of what a few years ago were the secrets of European nations only.

The manufacture of high-speed and special steels are also receiving attention. Again, many firms have branched out into the manufacture of machinery and other utilities which for decades had been solely monopolized by Austria and Germany. During the winter and spring shipbuilding will receive much attention provided the necessary steel for construction can be obtained. The prospects for the coming winter are brighter than a year ago, and the cry of the unemployed will be less heard than in previous times.

Pig Iron

Producers are still striving to keep up with the pace being set by the steel manufacturers and are on the whole very successful. Production still continues with unabated energy. Market prices in the States show advances, but local conditions remain unchanged.

Steel

The unsettled state of the market still continues with prices advancing steadily. Quotations made to-day may not be in force to-morrow, and price lists are no longer to be relied upon. In some instances steel for war munitions is booked a year in advance, and with the mills producing maximum capacity in the majority of cases it is apparent that little opportunity is imminent for the supply of steel shapes and bars for domestic purposes. The latter begins to assume greater importance than a few months ago indicated.

What the situation will be in a short time is at present difficult to determine, but that prices will advance still further is quite evident. Some of the large producers in the States have refused large export orders for plates and bars, even at a price much higher than that now quoted, and with the possibility of foreign countries requiring large shipments of steel from this continent, for several years to come, the conclusion is that the current high prices will be maintained for an indefinite period.

> **CANADIAN GOVERNMENT PURCHASING COMMISSION**
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> **The following gentlemen constitute the Commission appointed to make all purchases under the Dominion $100,000,000 war appropriation:—George F. Galt, Winnipeg; Hormidas Laporte, Montreal; A. E. Kemp, Toronto. Thomas Hilliard is secretary, and the commission headquarters are at Ottawa.**

The market in steel bars, plates and structural shapes is very active and prices are advancing daily. Bars show an increase, and are now quoted at 2.55 cents per pound. Shapes are 2.30c, being an advance of one-tenth cent per pound. Plates are also strong at 2.30c. Boiler heads have advanced and this week's quotation is $3 per hundred pounds. Lap-welded boiler tubes have taken another jump and an advance of 6 to 10 per cent. is noted in this week's list.

Machine Tools and Supplies

Added to the already high pressure being placed upon the machine tool builder for the output of shell making machinery, are the inquiries that are now coming in for equipment for the production of domestic specialties. Complaints are still being received from customers regarding delivery on certain machines ordered months ago, and now long overdue. The return of normal conditions in industrial spheres outside of those bearing on the war situation is tending to create a high optimistic outlook, and the prospects for the coming year are that the machinery trade will maintain for a long time its present activity. All lines of the metal working trade are more or less affected by the scarcity of high-speed steel, and in some cases very abnormal prices have been offered for this much-needed accessory to finished production. High-speed steel is quoted from $2.50 up. Supplies of all kinds are still in demand with prices firm.

Metals

The close approach of the end of the year finds the market in a quiet and inactive condition, and the prospects for the remainder of the year are that little change need be looked for. The feature of the week has been the unstable position of spelter, this being the outcome of speculators trying to deceive the market.

Copper.—Very little activity is noted in copper; the market is dull with prices holding firm. Foreign markets in some quarters are showing weakness while others appear stronger.

Tin.—The present state of the market shows plenty of tin on hand; in fact, the visible supply is in excess of the demand. Reports of the sinking of vessels in the Mediterranean, one or more of which may have cargoes of tin aboard, has created some excitement among buyers. However, unless these reports should be followed by increased activity among the dealers, no advance is looked for. The local market for the past week has been dull and a decline of $20 a ton is quoted, the price this week being 45c per pound.

Spelter.—The sand foundation upon which the spelter market has been resting for the past few months is beginning to totter. Owing to speculation on the part of large buyers and also the holding back of available supplies by producers the situation at the present time shows some signs of demoralization, and a decline in prices is daily expected. Quotations in foreign markets are showing sharp declines, and it is anticipated that local dealers will follow suit shortly. Last week's prices prevail at 20c per pound.

Lead.—Little change is noted in the position of lead over that of last week, and the market is quite dull, with a tendency to decline. No change in price has taken place in local markets and dealers are quoting $6.75 per hundred.

Antimony.—Local dealers are quoting last week's prices, but the market generally is showing weakness and a decline is looked for any time. Inquiries are fairly good at 42c per pound.

Aluminum.—Increased demand for aluminum has advanced the price this

week and dealers in this district are asking 65c per pound, being an increase of 3c.

Old Material.—The scrap metal market continues to retain a steady tone, and prices are holding firm. Dealers report good business in copper and heavy melting steel, with prices unchanged. The general situation remains the same as last week with the exception of scrap zinc, which is weaker, being now quoted at $12.75. Scrap aluminum is very strong at 27c per pound, with little on the market.

Toronto, Ont., Dec. 7.—Industrial conditions continue to show a decided improvement and a better feeling prevails in business circles. The success of the war loan is gratifying, and, representing a response far ahead of expectations, it cannot help but stimulate the returning confidence of the public generally in the financial and business outlook. The trade returns issued by the Department of Trade and Commerce for the month of November show an increase in revenue of over 7½ million dollars over that of November, 1914. The total revenue for November, 1915, was just over 17 million dollars, and the largest of any month in the history of the Dominion. For the eight months of the present fiscal year ending Nov. 30, the total revenue aggregates $104,750,000 as against $90,400,000 for the corresponding period in the last fiscal year.

The steel trade continues very active and the mills, although operating at capacity, are getting behind on deliveries. Forging plants and machine shops are getting behind on deliveries. Forging plants and machine shops are also working at full pressure and preparations are being made to handle the large shells. Machine tool builders are very busy turning out machines for shell plants. Prices of all machinery is advancing due to the increased cost of raw materials. There is a good demand for ingot metals for munitions, but the market is dull and weaker. Tin and spelter are lower.

Steel Markets

The market is very firm and prices have a higher tendency all round. The volume of business being done is larger than it has ever been and the mills are unable to meet all the demands. The steel companies are booked up for months ahead, pricipally on tonnage for shells, although a large export business is being done in other lines of steel products. The steel trade is passing through a period of prosperity, the like of which was never before experienced. The steel companies, although working night and day, cannot keep pace with the demand and are therefore getting behind on deliveries. The demand for steel for shells is taking the capacity of mills to the limit, but plants are being extended to take care of the increased business.

Prices on finished and semi-finished steel products are very firm, with a higher tendency for most lines. A few advances have to be noted such as lap-welded boiler tubes, wood screws, wire nails, cut nails, grey forge pig iron and Lake Superior charcoal iron. Warehouse prices for Pittsburgh bars, etc., are higher. Steel bars are still being quoted at 2.75c and iron bars at 2.50c, but higher prices are expected in the near future. Wrought iron pipe is very firm and may go higher. Smooth steel wire has advanced 15c and is now quoted at $3 base. Pressed steel spikes ⅝ in. diameter, have advanced to $3.25 per 100 lbs. Prices of Pittsburgh bars, plates and shapes are still withdrawn and the situation is unchanged.

The situation in the galvanized sheet trade does not improve. Manufacturers are handicapped by the shortage of steel, the scarcity of sulphuric acid, and high price of spelter. Prices of galvanized sheets are very firm at the advance announced last week, and there is a probability of further advances. Prices of black sheets are strong and are slowly advancing. Black No. 28 gauge are quoted at from 2.40c to 2.50c, Pittsburgh base. Blue annealed No. 10 gauge are quoted at from 2.15c to 2.25c, Pittsburgh base.

In the United States market, the advance in prices continues and the difficulties of quoting the market are increased by the inability of many producers, particularly on billets and wire rods, to take any of the business offered. As regards buying of shell steel, deliveries reaching to November, 1916, are now being considered in connection with business from one country in Europe. The market for large rounds is very strong, but rather less active.

Other small steel bars are still being quoted at 1.70c Pittsburgh, but this figure is more or less nominal, 1.80c being nearer the market, Pittsburgh. Buyers of billets are experiencing considerable difficulty in getting their needs supplied. There is a big demand and the scarcity is getting more acute. Prices continue to advance. Bessemer billets are now quoted at $29, open-hearth billets at $30, and forging billets $52 base, f.o.b. Pittsburgh. Steel hoops have advanced to 1.90c Pittsburgh.

Pig Iron

The market continues very strong and prices of all American brands of pig iron have advanced. It is reported that a shortage of iron is threatened, particularly at Buffalo. All quotations on charcoal irons have been withdrawn by the principal Lake Superior district producing interests. Lake Superior charcoal iron has advanced to $17.75 Chicago, and grey forge to $16.95 Pittsburgh. Hamilton and Victoria brands are firm but unchanged at $23 per ton.

Machine Tools

The situation in the machine tool market is unchanged. Dealers are very busy figuring on shell equipments and have lately sold a number of lathes for machining 6-in. shells. An interesting feature in the trade is the development of special machines for making shells and shell parts. This work is keeping a number of smaller machine shops actively employed and the larger concerns are also very busy turning out machinery for making shells. Machine shops continue to work at full pressure, both those making shells and those making machinery for shells.

Supplies

The active demand for machine shop supplies continues and business is very brisk. Prices generally are very firm. Milling cutters have advanced again, and are now practically 150 per cent. higher than they were 12 months ago. There is no improvement in the high-speed tool steel situtaion and prices now range from $2.85 to $3.05 per pound. Tungsten is still very scarce and prices continue to advance. Gasoline, benzine, turpentine and linseed oil are all very firm and higher prices are expected.

Old Materials

The market generally has a weak tendency, but prices are unchanged, except for No. 1 wrought iron, which is stronger and has advanced to $9.50. Heavy melting steel is in good demand, as also are the different grades of copper.

Metals

There is an easier tendency in the market this week and both tin and spel-

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ALLIES PURCHASING AGENTS

The Trade and Commerce Department, Ottawa, has published the following list of purchasing agents for military purposes for the allied Governments:

International Purchasing Commission, India House, Kingsway, London, Eng.

French.—Hudson Bay Co., 56 McGill Street, Montreal; Captain Lafoulloux, Hotel Brevort, New York; Direction de l'Intendence Ministere de la Guerre, Bordeaux, France; M. De la Chaume, 28 Broadway, Westminster, London.

Russian.—Messrs. S. Ruperti and Alexsieff, care Military Attache, Russian Embassy, Washington, D.C.

ter have declined. The tin market is dull in London, the weakness being attributed to the increase in visible supplies. The spelter market appears to be demoralized in New York, following a decline in London. The copper market is quiet and prices nominal. There is no change in lead and the market is dull. Antimony has an easier tendency and aluminum is also unchanged.

Tin.—The tin market continues to decline to a more normal basis. The recent sharp advance was quite unwarranted and the market will no doubt get back to the price prevailing immediately previous. The visible supply is increasing and there is less fear of any shipments being lost through submarine operations. The local market is weak and has declined 1c. tin being now quoted at 45c per pound.

Copper.—The local market is very quiet and will probably remain in this condition for the next two or three weeks. The recent buying movement has died down and the tendency will be for consumers to stay out of the market for the balance of the year. The market has become a purely nominal one and quotations are unchanged at 20¾c per lb.

Spelter.—The market is demoralized in New York, and there is a lack of support on the part of the large interests. The market has been following London and a sharp drop there affected New York. Buyers are holding off and prices are nominal. Spelter is weak locally and has declined 1c, being quoted at 20c per pound. Zinc ore is quoted from $100 to $115, Joplin, Mo.

Lead.—The market is dull and featureless, the "Trust" price of 5.25c being still held at New York. Local quotations are unchanged at 7c per pound.

Antimony.—The market is dull and prices remain about the same on all positions. Antimony is unchanged locally at 40c per pound.

Aluminum.—The market is easier, but prices are unchanged. Supplies of aluminum are coming in rather more freely, which will have a tendency to weaken the market. Local quotations are unchanged at 65c per pound.

Solder.—The market is weaker following the decline in tin, and prices have declined. Solder, "half-and-half," is now quoted at 24c per pound.

WINTER MAIL PORT CONTROVERSY

IN the annual controversy between Halifax, N.S., and St. John, N.B., as to their respective merits as winter ports, a letter written by Sir Thomas Shaughnessy, president of the Canadian Pacific Railway Co., is taking a very important place this year. The letter was in reply to one from Sir Robert Borden, who had placed before Sir Thomas Shaughnessy telegrams and letters from the Halifax City Council and Board of Trade registering strong protests against sending the Corsican and other mail ships to St. John without calling at Halifax. The letter of Sir Thomas Shaughnessy to Sir Robert Borden reads as follows:—

"I wish that it were possible to comply with your request to have our passenger ships call at Halifax on the inward and outward trips this winter, but, as I said to you personally, I am convinced that it cannot be done in the interest of the country.

"The war has brought upon us a condition of things with reference to our Atlantic steamship service that could not have been foreseen, and that it will be difficult for us to satisfactorily meet, even with out greatest efforts. As you know, a great many of our ships have been taken by the Admiralty, and we have found it impossible to charter a sufficient number to replace them.

"In these circumstances we must either utilize such steamships as are available to the utmost, or we must permit a substantial percentage of our Canadian exports to be diverted from Canadian ports.

"Apart from all other considerations, the Halifax call would involve a delay to our passenger ships of from two or three days on each round voyage, with a like reduction in their freight carrying efficiency. Our endeavor must be this winter to avoid unnecessary detention of a single hour, so as to secure the fullest advantage of their carrying capacity. By running direct to and from St. John, in these exceptional circumstances to which I have referred, no precedent is being established.

"When normal conditions return, the Halifax mail service and the terms upon which it is to be conducted will be open for consideration."

CANADIAN PURCHASES FOR FRENCH WAR OFFICE

Philippe Roy, General Commissioner for Canada, Paris, advises the Department of Trade and Commerce, Ottawa, that an order has been issued by the War Department of the French Government to the effect that all purchases made by the Supply Branch in Canada will pass through the Hudson Bay Co. Canadian producers should therefore submit their future offers through the office of that company at Montreal. It is further stated in Mr. Roy's communication that Canadian lumber, steel and meat will find in France an important market for years to come, but it is necessary that Canadian firms should have in Paris representatives entrusted with the necessary authority, especially if it is desired to secure Government contracts.

REMEMBERING EMPLOYEES AT THE FRONT

ARTHUR MARSH, brother of Lt. Col. Marsh, president of Marsh & Henthorn, Belleville, Ont., and Bombardier Ed. Blaylock, a member of the office staff, who spent last Christmas in Salisbury Plain Camp, and who knows the needs of the soldiers at the front have prepared a large number of Christmas boxes, weighing the limit of eleven pounds each, one for each former employee of the firm now on active service. The firm and the entire office and munition staff contributed to the gifts. Each man gets a box containing the following:

Three plugs 10c "Prince of Wales" chewing tobacco.
One 30c plug "T & B" smoking tobacco.
Fifty "Sweet Caporal cigarettes in tin box.
One 25c pipe.
Two small boxes safety matches.
Five packages chewing gum.
Five packages chocolate.
One box "Lifebuoy" soap.
One pad writing paper.
One bundle envelopes.
One pencil.
One tin of sardines.
One tin of condensed coffee.
Half-pound tin Brazil nuts.
Half-pound of shelled walnuts.
One package of dates.
Twenty-five cent tin "Oxo."
One tin of "Paris" pate for sandwiches.
One Christmas cake, 1½ lbs.
One package butter scotch.
One steel mirror in case.
One tin insect powder.
One tooth brush.
One pair leather mitts, oil tanned.
One pair 50c socks.
One package bachelor's buttons.
Two handkerchiefs.
One hand towel.

The men who fire the munitions will certainly be deeply appreciative of the thoughtfulness of their comrades who are making the shells.

NOVEMBER REVENUE A RECORD

THE war budget is giving results exceeding the most sanguine expectations of the Minister of Finance. The total revenue for the month of November is $17,072,456.76, an increase of $7,576,-920.46, over that of November of last

year, and the largest for any month in the history of the Dominion.

For the eight months of the present fiscal year, ended November 30th, the total revenue aggregates $104,750,000, as against $90,400,000 for the last fiscal year, when, owing to the effect of the war, trade was badly demoralized during August, September, October and November, of the eight months in question. The estimate of the Minister of Finance that his budget of February last would realize thirty millions of additional revenue is not certain to be substantially exceeded.

The policy adopted by the Government at the outbreak of the war of proceeding only with works actually under contract is now bearing its full fruit. For the first eight months of the current fiscal year the ordinary expenditures show a reduction of over ten million dollars, and the capital expenditures of about three millions. Between increased revenue and decreased expenditure the financial position this year as compared with the previous year shows a favorable balance of twenty-seven million dollars. The Dominion is thus daily becoming stronger to meet the increasingly heavy expenditures of the war.

CANADA'S WAR LOAN

THE Government has decided to make the Canadian War Loan one hundred instead of fifty millions. The extra fifty millions will be obtained from the sixty odd millions of the over-subscriptions to the original loan, and will be used as a credit for the Imperial Treasury to pay for shells, munitions and other war supplies ordered by the Imperial Government.

It is the first step towards doing Canada's fair part in helping the motherland to finance the enormous war expenditure of $25,000,000 per day, which the Imperial Treasury has hitherto borne unaided. It means that the Government has definitely embarked on the policy on helping the motherland not only with men and munitions, but also with money, and of returning, in part at least, the assistance which the Dominion has received from Britain in the way of war loans and through half a billion dollars' worth of war orders. Later on, when the first fifty millions of advances to the Imperial Treasury are exhausted, the Government will "devise a plan whereby with the co-operation of the chartered banks a further credit for the same purpose will be created."

Before the war is over the extent of this financial aid to Great Britain is likely to amount to $300,000,000 or more—all of which will eventually be paid by the motherland, and is being immediately paid in the shape of war orders, which are keeping Canadian industries busy.

C.P.R. PURCHASES FOR BRITISH GOVERNMENT

THE C.P.R. is providing the British Government with war necessities ranging over a wide field. Excluding horses, fodder, ammunitions and munitions, there is hardly anything that could be mentioned that the company is not interested in purchasing, if it can show relation to the needs of the military in the field. The amount ordered at first was small, because the British authorities did not know to what extent Canada could supply the articles needed. In fact the orders at first did not total $500,000, but when Sir Thomas Shaughnessy went over to England and consulted with the authorities he was able to inform the latter as to the aptitudes of our Canadian manufacturers.

The orders include millions of pairs of socks and drawers. Shovels and spades are in much demand by the military authorities on the other side, with whom the C.P.R. deals entirely, placing its experience at the disposal of the British War Office, in a spirit of patriotism, rather than in that of a huckster. Handled axes have been in great demand; and the country has been scoured for them. Wire cable was badly needed, and hundreds of miles of it have been ordered by the C.P.R. department. Rubber boots of the full hip pattern, snowshoes, cheese, safety matches, shoepacks, evaporated vegetables, including potatoes, which are in great demand, etc.

Cement sacks were secured from the Canada Cement Co., to the number of 8,000,000 chisels, screw-drivers, vises, brass drills, shears, augers, punch cutters, helmets, etc.; in fact, there is nothing which could be included in the necessary outfit of troops in the field which is not in demand.

The British authorities could take many more things which Canada does not, as yet, manufacture, but the C.P.R. has focused every manufacturing interest in the country on Room 114, on Windsor street—a room which displays no sign, hints no business, but in which are thousands of samples, and always a large number of manufacturers, or their agents, for the company deals direct.

To date more than five million dollars' worth of goods and materials have been purchased.

BANKERS DISCUSS MUNITIONS' FINANCING

THE Minister of Finance on Dec. 2, conferred with a Committee of the Canadian Bankers' Association whom he had invited to Ottawa to discuss with him the extent to which Canada might assist in the partial financing of Great Britain's expenditure for shells, munitions and supplies in Canada, and the means by which such assistance could be best afforded.

It is understood that such methods as the issue of Dominion notes against gold deposited in London, acceptances of bills of exchange and advances to manufacturers and others against Treasury bills or other securities, were discussed. It is believed that the Minister of Finance has in mind a plan which will materially assist in the financing of the purchases in Canada by the Imperial Government during the next six months or year.

The suggestion has been put forward frequently since the outbreak of the war that Canada should finance her own war expenditures in their entirety, as well as the purchases of Great Britain and the Allies in Canada. The following figures show the nature of the problem.

Canada's war expenditure from the outbreak of the war until December 31st, 1916, will probably amount to $400,000,000. The purchase of Great Britain and the Allies of supplies and munitions will probably by that date have exceeded $600,000,000. The total of Canada's war expenditures and purchases by the Allies will thus be over one thousand million dollars. Up to the outbreak of the war Canada had been, and is still a borrowing country, depending upon outside money markets for the sale of her Dominion, provincial and municipal securities.

As Canada has no international money centre like New York or London, where accumulations of capital are available for short-date Treasury loans or for the sale of Government securities, it is obvious that Canada will not be able to provide funds for the whole, but for only a part of her own war expenditure, and by way of advances for the expenditure in Canada by the Allies for supplies and munitions. Only by production and saving is it possible to increase the supply of Canadian capital available for this purpose.

Laurentide Power Co. Board.—J. E. Aldred, president of the Shawinigan Water & Power Co., and Cedars Rapids Power, has been chosen as president of the Laurentide Power Co., while F. A. Sabbaton was elected vice-president. The other members of the board include Edwin Hanson, C. R. Hosmer, George Chahoon, jun., J. H. A. Acer, Howard Murray, Julien C. Smith, and Secretary-Treasurer W. F. Robinson. One vacancy on the board remains unfilled, and it is held for a representative to be named by the Shawinigan Water & Power Co.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

St. Mary's, Ont.—C. Richardson & Co. are equipping a plant for making shells.

Hamilton, Ont.—The Tallman Brass Co. are making an extension to their plant.

Toronto, Ont.—The Multipress Co. is in the market for drop hammer and screw presses.

Lachine, Que.—The Dominion Bridge Co. are building a brass foundry at a cost of $20,000.

Hamilton, Ont.—The Acme Stamping Tool Works will make an extension to their plant to cost $3,000.

Toronto, Ont.—The Chapman Double Ball Bearing Co., have started work on a further addition to their plant.

Blenheim, Ont.—The Pere Marquette Railway Co. may instal a pumping plant here, taking water from the River Eau.

Wallaceburg, Ont.—The Wallaceburg Brick Co. will erect an addition to its plant and will install machinery for the manufacture of tile, etc.

Waneta, B.C.—The Waneta Development Co. will construct a hydro-electric power plant at the Columbia and Pend O'Reille Rivers, B.C., to have a capacity of 80,000 h.p.

Peterborough, Ont.—The Peterborough Metal Products Co. will take over the premises formerly occupied by the Canadian Cordage Co., and will install machinery for manufacturing metal products.

Englehart, Ont.—A representative of the Riordan Paper Mills of Montreal, has closed a deal for the old Foster Mill at Haileybury, and are placing new machinery in it for rossing the pulpwood they expect to purchase in Temiskaming.

Welland, Ont.—The Canada Forge Co. will build an extension to their plant. The new building will have an area of 180 x 80 feet, and will be of structural steel. The cost is estimated at $20,000, and the equipment to be installed will cost $100,000. T. J. Dillon is manager.

Ottawa, Ont.—A private concern, the Transcona Shell Company, will make shells in one of the several extensive shops of the Transcontinental Railway, near Winnipeg. The G. T. P. some time ago secured a contract, but has since transferred it to the Transcona Shell Co. It is understood that Montreal capitalists, headed by Sir Edward Holt and Henry Timmins, are interested.

Municipal

Otterville, Ont.—A hydro-electric system will be installed here to cost $2,150.

Lambeth, Ont.—The town will construct a pump house and install new machinery.

Huntsville, Ont.—The town council will build a sub-station and improve the power plant and distribution system.

Sarnia, Ont.—The City Council have decided to lay an intake pipe from the third basin of the Point Edward plant out into the lake.

West Lorne, Ont.—It is proposed to spend $8,000 on a hydro-electric power system. A by-law will be submitted to the ratepayers on December 20.

Sherbrooke, Que.—The city council are considering alterations and improvements to the water power, electric transmission and lighting plants.

Edmonton, Alta.—The City Council contemplate spending $274,967 on a sewage disposal plant. A by-law will be submitted to the ratepayers on Dec. 13.

Springfield, Ont.—A by-law will be voted on by the ratepayers on December 9 to authorize an expenditure of $5,000 on the installation of an electric light plant.

London, Ont.—It is announced that owing to the increase of the consumption of hydro power the rate charged London by the Ontario Commission would be reduced January 1 from $24 to $22.

Cornwall, Ont.—The town will purchase a new pump and make extensions to its waterworks system to cost $25,000. A by-law will be voted on by the ratepayers on January 3.

Sarnia, Ont.—The city contemplate improvements and extensions to the water distribution system. A by-law will be voted on to sanction the necessary expenditure, which is estimated at $12,000.

Berlin, Ont.—The City Council have decided to submit a hydro-radial by-law for $779,000 to the ratepayers. Waterloo Town and Waterloo Township Councils also voted in favor of submitting similar by-laws, the former for $193,000, and the latter for $521,903.

Winnipeg, Man.—City Engineer W. P. Brereton has recommended the installation of two gas engines at the high-pressure plant on James Ave., to be used to develop electrical energy sufficient to operate two 5,000,000 gallon motor-driven booster pumps at the McPhillips street pumping station. The cost of this stand-by arrangement would be $21,000.

General Industrial

Windsor, Ont.—The Vacuum Street Cleaning Machine Co. are considering the building of a factory in this district.

Fort Erie, Ont.—The International Safe & Register Co., contemplate the erection of an addition to their factory shortly.

Nelson, B.C.—Donald Fraser, Ltd., Fredericton, N.B., have commenced the re-erection of their sawmill on the Miramichi River.

Hamilton, Ont. — The Proctor & Gamble Co., soap manufacturers, have had plans prepared for an addition to their factory.

Toronto, Ont.—A fire last Friday damaged the Gold Medal Furniture Mfg. Co. factory to the extent of $100,000. W. J. McMurtry is the manager.

St. Catharines, Ont.—The Marathon Rubber & Tire Co. have begun the erection of a factory, and expect to have the plant in operation by the first week in March.

Saskatoon, Sask.—The Alaska Bedding Co., of Montreal and Winnipeg, have purchased the entire plant of the Stamco Mfg. Co. The building has been taken over by the T. Eaton Co., and the Alaska Bedding Co. will store the machinery until the spring, when it will probably be utilized.

Moose Jaw, Sask.—Two large manufacturing concerns, one of Vancouver, B.C., and the other in Iowa, are looking at Moose Jaw favorably at the present time, as a most suitable city in which to establish branch factorires. The Vancouver firm is interested in the manufacture of brushes and brooms, while the Iowa firm manufacture fountain pens.

Large Shells: Production Problems and Possibilities---V.

By C. T. D.

In preparing to undertake the production of large shells up to 9.2 in. dia., manufacturers will encounter problems of a nature altogether different from those connected with 18 pdr. shells. Automatic machinery will not be so applicable to the larger sizes, and productive ability will centre largely on such points as sequence of operations, tooling methods, etc.

ALTHOUGH the majority of manufacturers who have undertaken the production of large shells are already operating plants of more or less magnitude, they are more than likely to find that a considerable number of new machines will be necessary in order to maintain deliveries. Those firms who are already established, especially in lines of a general nature, will lean towards the adoption of machines which possess features and quality of more than temporary interest. The increased industrial activity which is ultimately expected justifies the selection of machine tools which can be expected to continue rendering good service for years to come.

Machines of this class have been produced by several makers during past years, which, although primarily adapted to munitions manufacture, are of considerable value as producers in establishments of the class referred to.

The installation of such machines at the present moment, while initially more costly, is ultimately a double economy, because, firstly, they are the result of many years' experience by large organizations, who have made a success of work of this kind. They have been tested out under months and years of severe service, consequently their makers can supply them with the assurance of immediate production without that experimenting which has so frequently to be done when one is operating along new lines. Secondly, when their work on war material is finished, their sound design and first-class construction give them a high permanent market value, whether they are retained in a factory or offered for sale.

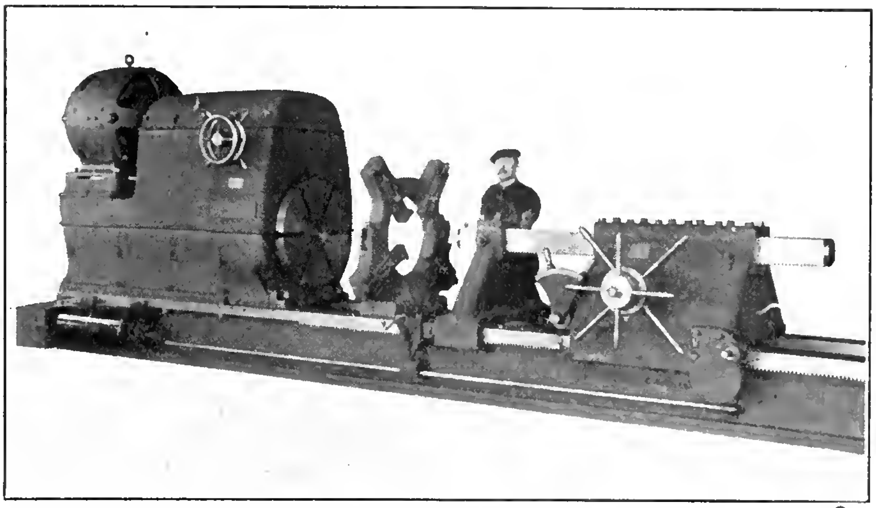


FIG. 15. PROJECTILE BORING LATHE FOR SHELLS FROM 6 IN. TO 12 IN. DIA.

For many years the John Bertram & Sons Co., of Dundas, Ont., have specialized in the building of machine tools of the highest grade for many lines of engineering work, and their activity in providing equipment for munitions plants has been characterized by all the features of their normal efforts.

The accompanying schedule of operations suggested by them is based on use of machines which have been developed specially for large projectile work, yet have that value for other lines which appeals to the fore-armed manufacturer. Minor operations are performed on existing types of machines which call for no special comment.

Comparing these operations with previous suggestions, the principal feature observed is the thoroughness of the methods adopted. For instance, when finish turning the body in the fifth operation, the shell is mounted on a special arbor which extends through the nose, thus insuring absolute concentricity between inner and outer surfaces. While the careful performance of previously published methods on miscellaneous machines would produce work of the required accuracy, the absolute certainty of these methods ultimately results in greater output.

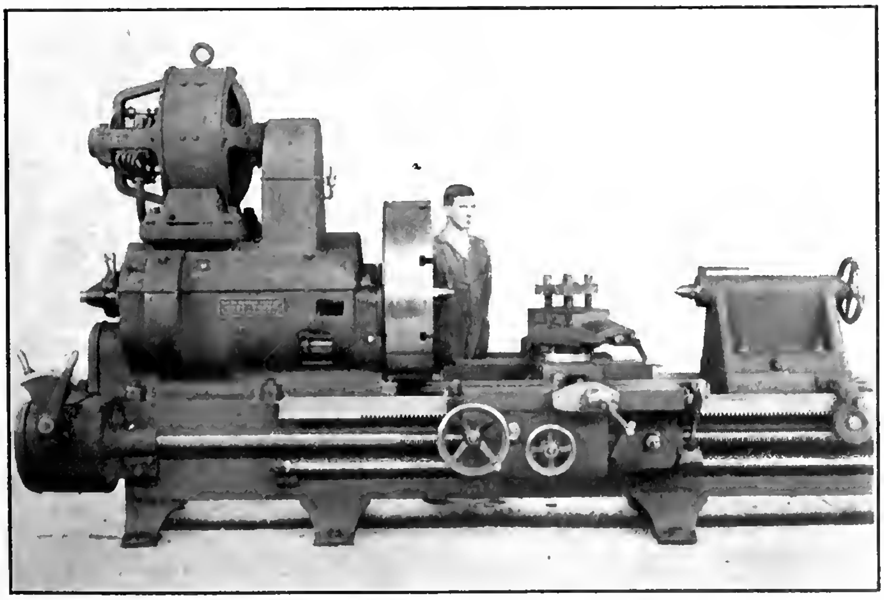


FIG. 14. 36-IN. MOTOR-DRIVEN LATHE FOR TURNING LARGE SHELLS

Illustrations of the principal machines referred to are shown in Figs. 14, 15 and 16. Fig. 14 shows the 36 in. heavy duty engine lathe used for the third operation. While of seemingly conservative design, this machine has several features which call for more than passing mention. The strain of constant heavy cutting on rough forgings demands more than ordinary stiffness, and both the main spindle and the tailstock spindle are supported in such a manner as to insure the desired rigidity. The drive is from a variable speed motor, with a minimum amount of gearing, which is entirely enclosed. The headstock is of box form, the side walls imparting considerable added stiffness to the spindle bearings.

A very liberal amount of bearing surface is provided for the carriage, while the attention given to such important

details as lubrication and the provision of dust scrapers to prevent the entrance of cuttings beneath the carriage are points which appeal to the judicious purchaser.

The machine which is of the most immediate interest at the present moment is the heavy projectile boring lathe, shown in Fig. 15. This machine swings 36 in., and is suitable for rough and finish boring projectiles from 6 in. to 14 in. diameter. The design throughout is of a most substantial nature. The bed sits flat on the foundation over its entire length, flat tracks and large cross section being prominent features in the design.

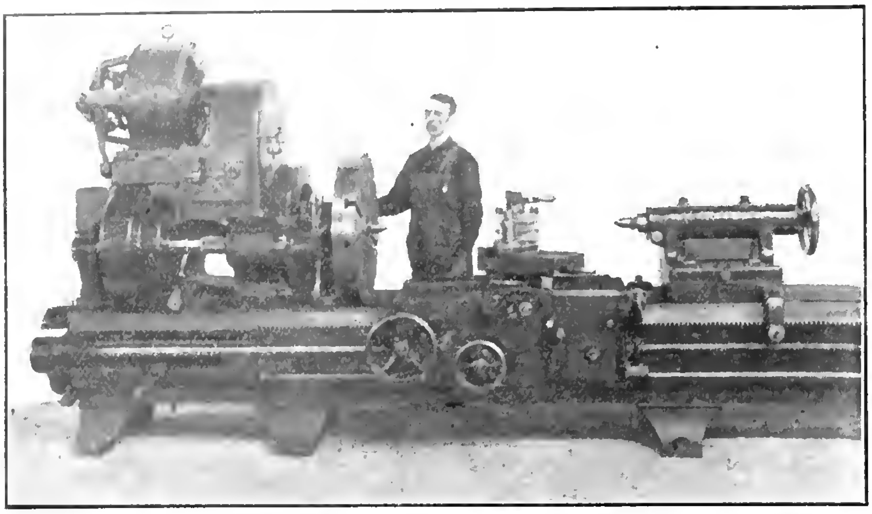


FIG. 16. 30-IN. ENGINE LATHE FOR GROOVING AND BAND TURNING.

The headstock is of box construction, with all gears enclosed, the direct connected motor being mounted on a pedestal above the rear bearing. The front spindle bearing is 8 in. dia. x 23 in. long, these dimensions conveying some idea of the liberal proportions throughout. The bearings and gears, which are entirely enclosed, are lubricated continuously from a high level tank contained in the head, the oil being constantly pumped up from the bottom of the headstock.

The 35 horse-power motor is of the variable speed type, and the gearing through which it drives gives three mechanical changes controlled by handwheels. The electrical control of the motor gives 20 variations, which, combined with the gearing, gives 60 different face plate speeds from 2½ to 77 revs. per min. The control shaft extends along the front of the bed, and the con-

Sequence of Machining Operations for 9.2 in. Howitzer Shell Forgings.

Drill Center Hole and Face Nose of Shell

Performed by heavy radial drill. The shell is dropped over an arbor which fits the shell, and which is located central with drill spindle. The twist drill used is a little smaller than the size of the bottom of the thread in the nose, enough stock being left to make a reaming operation. After the hole is drilled twist drill is taken out, and a pilot facing cutter is used, which sweeps off the nose end of the shell, giving a flat surface, a little larger than is required for the finishing end.

Cutting-Off the Open End

For this operation heavy cutting-off machines are used, the shell being held in the spindle of the cutting-off machine, back against a stop, or in some cases a heavy engine lathe is used, to the face-plate of which is attached a heavy split cast iron chuck, open end of which runs in steady rest.

Rough Turning Forgings

This operation is performed on 36" heavy duty engine lathe, and the open end of the shell is placed on an expanding arbor which grips the inside bore, the tailstock having a revolving center, fitting in the hole already drilled in operation 1. This machine is arranged with a profiling attachment, so that the roughing cut will turn the outside of the shell to shape.

Boring Out the Shell

This operation is performed on a 36" projectile boring lathe, which is motor driven. To the faceplate of the lathe is bolted a heavy cast iron split chuck, which is supported on the outer end, by heavy steady rest. The shell is slipped into the chuck, and clamped in position. The projectile boring lathe has a heavy square steel bar running through the tailstock, and is driven by all steel gearing, and has sufficient power to carry a three fluted roughing reamer, each cutter of which has serrated edges for breaking the chips. After this cutter is driven in the desired depth, it is withdrawn and the second cutter bar takes its place. The second cutter bar is of acorn shape, having two high speed steel cutters of the desired shape to finish the internal bore of the shell. This operation demands a heavy machine, as while the operation is performed in a comparatively short time, the character of the work must be perfect.

Finish Body Turn

This operation is performed on a 30" heavy duty engine lathe, the shell being mounted on a special arbor, conforming to the inside diameter of the shell, with the arbor extending through the shell, and held in position by nuts on either end of the arbor, which is driven from the faceplate. The lathe is provided with a special forming attachment, which enables the operator to not only turn the outside diameter of the shell to an exact size, but also gives a perfect form to the nose of the shell.

Boring and Threading the Nose

For this operation 26" heavy duty lathe is used, the large end of the shell being held in chuck bolted to faceplate of the lathe, and body of the shell running in steady rest. The lathe is provided with a turret on the carriage, enabling the use of a number of tools in rotation for this operation, the hole being reamed out to the proper size for threading, the nose of shell being faced to a finish, the thread being cut by collapsible tap, and a tool being used of suitable shape to face up the inside of the shell back of the thread.

Waving and Undercutting

A 30" heavy duty lathe is used on this operation, or special lathe of heavy design, equipped with a waving and undercutting attachment. This attachment consists of a fixture bolted to the bed of the lathe, and having at the back two tools operated by cams which remove the stock and undercut the corners. The front tool on the fixture has the required number of depressions for the number of waves required, and is operated by a cam on the faceplate which completes the form, giving the waving motion required.

Counterboring and Threading the Base

A heavy duty 30" lathe is used having a large cast iron split chuck secured to the faceplate, with the open end running in steady rest. On the cross-slide of the lathe is located a heavy turret with the necessary tools required for the counterboring operations and facing of the end of shell. The threading is performed by a chaser of the desired pitch, which requires a number of cuts to cut the thread to the desired size.

Pressing the Copper Band to Place

The band being heated is slipped over the shell, and forced into the groove prepared for it, either in a steam hammer, by means of two half circle dies, a few blows only being required to force it into its place, or by an hydraulic press, either method giving very good results.

Turning the Copper Band

This operation is performed on a 30" heavy duty lathe, with special attachment, or a single purpose lathe with special attachment, the tool of the attachment roughing the copper band to an approximate shape, and the other tool finishing the band to an exact size and shape. To the fixture carrying the finishing tool is a special attachment for undercutting the copper band to suit the specifications.

Facing the Base Plug in Position

The base plug being screwed in place, the shell is then chucked in heavy duty 26" lathe, having a split cast iron chuck bolted to the faceplate, open end of which runs in a steady rest. The base plug having been left a little thicker than the depth of counterbore in the shell, the surplus stock is then removed, giving a perfectly flat surface on the base of the shell.

Turning the Base Plug

The base plug is a drop forging of suitable size with ample stock for finishing operations. The forging is chucked, faced and turned to the proper diameter, then threaded to an exact size, leaving the large diameter a little longer than is required to fill the recess in the shell, this surplus stock being taken off as stated in operation 11.

After the above operations have been completed, having been inspected at intervals during the process of manufacture, it is then necessary to varnish the inside and bake same. This leaves a perfect glass-like surface for the high explosive. Before shipment the shells are painted with vaseline, to prevent them from rusting. The work throughout has to be of a very high character, in order to suit the requirements, and conform to the specifications insisted upon.

trol handle is carried by a bracket, which can be moved along the bed as desired, giving complete control over the motor from the position most convenient for the operator.

As boring operations form almost the entire work of this lathe, special provision in the shape of a self-oiling roller type thrust bearing has been provided to prevent trouble under continuous heavy duty.

The tailstock is designed to carry a square boring bar of generous proportions, and made from a steel forging. The bar is fed forward by a pinion engaging with a rack on its underside. The feed shaft extends along the back of the bed. Mounted on the back end of the rack pinion shaft is a large worm wheel, the worm which drives it being driven from the feed shaft through a small train of spur gears.

The movement of the bar is controlled by suitable cutters, which are fed straight into the forging, the travel of the boring bar being in a straight line only.

The engine lathe shown in Fig. 6 is a 30 in. double-geared type, suitable for performing the various operations involved in grooving, waving and band-turning or forming. Although not of such massive design as the lathe shown in Fig. 14, it possesses all the elements of rigidity, the tailstock being liberally proportioned and securely bolted to its base block.

The four-sided tool post, shown in the illustration, is that which is ordinarily supplied. When equipped for grooving and waving, a special rest is substituted, consisting of a lower slide, which is mounted directly in the carriage, and has cross adjustment by a hand screw. A tool slide is mounted on this lower slide.

band lathe, the drawing showing the arrangement for the 9.2 in. shell.

The bearings are cast integral with the bed, and are of large size, the front one being $9\frac{3}{4}$ in. dia. x 7 in. long, and the rear 6 in. dia. x 7 in. long. Both bearing caps are machine fitted, and secured by four heavy studs, the forward cap being interlocked with the bearing to take the end thrust without end shift. Bearings are babbitt-lined and provided with shims for taking up wear.

The tailstock is a very rugged casting, located and bolted to the bed to suit the size of shell being machined. The spindle is 5 in. diameter, finished by grinding, and holds a heavy centre fitted to a No. 5 Morse taper. The spindle has a quick movement of about 6 in., actuated by rack and pinion. Its exact position is determined by a swinging stop at the rear, which drops over the end of the spindle when it has advanced far enough.

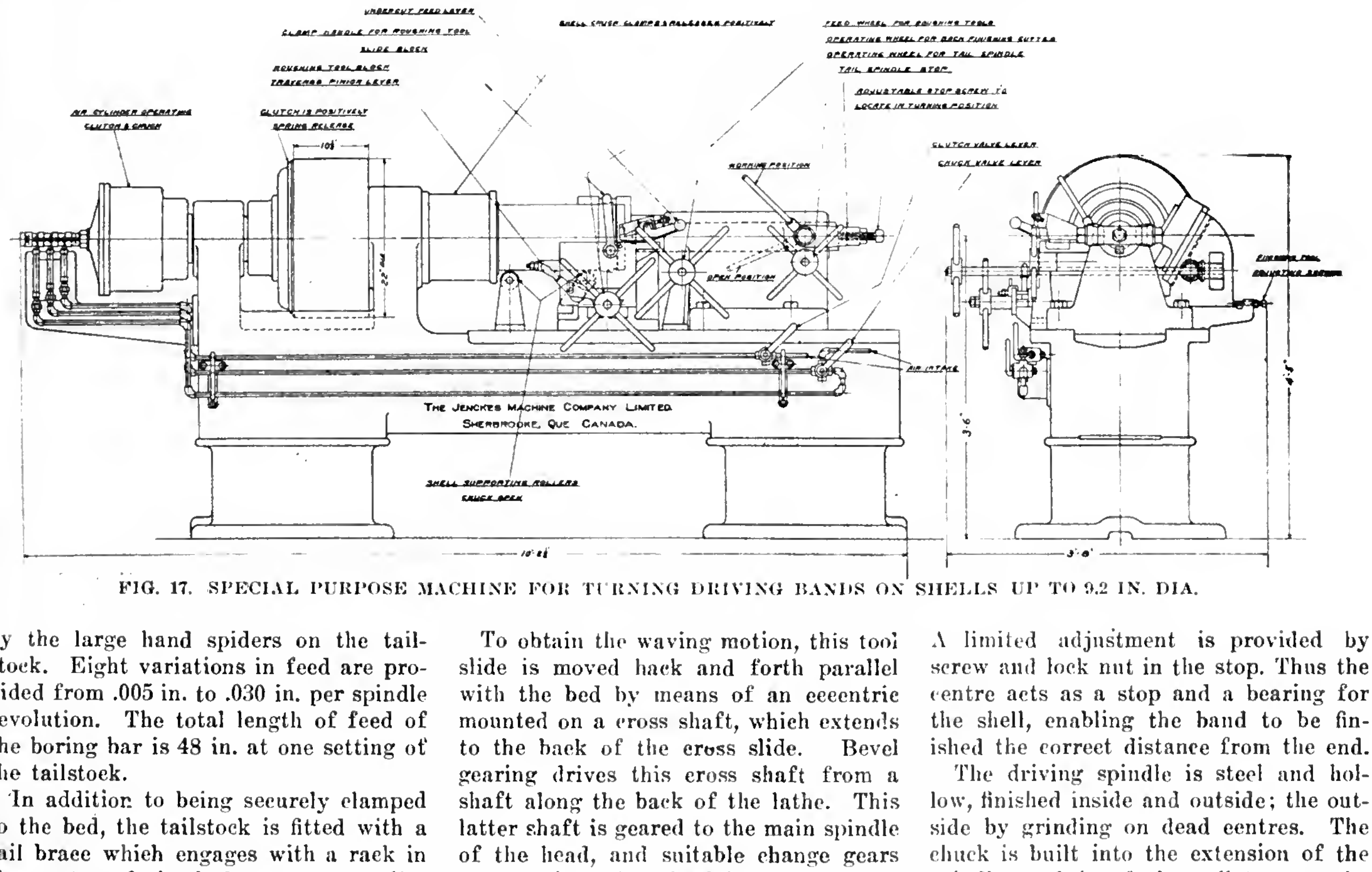


FIG. 17. SPECIAL PURPOSE MACHINE FOR TURNING DRIVING BANDS ON SHELLS UP TO 9.2 IN. DIA.

by the large hand spiders on the tailstock. Eight variations in feed are provided from .005 in. to .030 in. per spindle revolution. The total length of feed of the boring bar is 48 in. at one setting of the tailstock.

In addition to being securely clamped to the bed, the tailstock is fitted with a tail brace which engages with a rack in the centre of the bed, to prevent slipping under excessive thrust pressures.

The forward end of the bar is supported by an A-shaped bracket, which can be adjusted close to the mouth of the forging. This bracket aids greatly in eliminating vibration, and assists in the production of accurate work from irregular forgings. The steady rest is of stiff box section, with four rests, and has a capacity of from 6 in. to 20 in. in diameter.

When in use, this machine is fitted with boring heads of any desired style, the curved nose interior being formed

To obtain the waving motion, this tool slide is moved back and forth parallel with the bed by means of an eccentric mounted on a cross shaft, which extends to the back of the cross slide. Bevel gearing drives this cross shaft from a shaft along the back of the lathe. This latter shaft is geared to the main spindle of the head, and suitable change gears are provided for obtaining the number of waves required by the various shells.

While a machine of this type can be utilized for forming the bands, it is not always desirable to use a machine of such capacity on single operation work, except on the largest size shells. For use on shells from 8 in. to 12 in. dia. special band turning machines have been designed, one of which is shown in drawing, Fig. 17.

This machine has been placed on the market by the Jenckes Machine Company, of Sheerbrooke, Que., and is described as a single purpose air actuated

A limited adjustment is provided by screw and lock nut in the stop. Thus the centre acts as a stop and a bearing for the shell, enabling the band to be finished the correct distance from the end.

The driving spindle is steel and hollow, finished inside and outside; the outside by grinding on dead centres. The chuck is built into the extension of the spindle, and is of the collet type, the jaws being opened and closed positively by compressed air. It is operated by an air cylinder at the rear, the controlling valve of which is at the operator's right hand, below the tailstock. In closing the jaws, the shell is pushed forward until stopped by the tail centre. Jaw movement continues until the full pressure of the cylinder is exerted. The drive is through a single clutch pulley, 22 in. diameter, $10\frac{1}{2}$ in. face. The pulley is bronze bushed and runs loose on the spindle. The clutch is the full dia-

(Continued on page 549.)

The Development of Quick Acting Forging Presses--I.

By A. J. Capron, M.Inst. C.E.

The accompanying article formed the subject matter of a paper presented at the International Engineering Congress, San Francisco, last September. Recent progress and present status of the art of forging, together with the relative advantages of the quick-acting forging press over the steam hammer, constitute the salient features of the detail contents.

DURING the past ten years great developments have taken place in the art of forging, and over widening fields of industries, requirements in forgings have increased rapidly. In the first place, large forgings are required, particularly for the increased calibre of guns that have been coming into use, and for turbine drums, wheels, and spindles, in many cases requiring an ingot of as much as 100 tons weight.

Again, forgings are being much more extensively used in preference to steel castings. This applies particularly to marine work, where reliability is the first consideration, and some saving in weight is of more consequence than economy in production. It also applies largely to forgings of all kinds for general engineering work. When steel castings were introduced, they were used in many cases to replace forgings, at first often made in iron and subsequently in steel, the steel castings effecting a great saving in the cost of machining, particularly in the case of articles of intricate form. The introduction of high-speed steel during the last fifteen years has so reduced the cost of machining that forgings have been replacing castings, in many cases advantageously as regards the cost of production, and their use in this direction is continually extending. This development is greatly assisted by the improvements that have been made in the art of forging.

For the production of the heavier forgings, presses have been used in preference to hammers for as long as thirty years in many of the large steel works; but such presses are comparatively slow in their action, and it is only within the last ten years that great improvements have been made in their design and construction, and more particularly in their speed of working, which has rendered presses suitable for almost all classes of work, except the lightest forgings, which come within the range of small steam hammers or drop-stamps.

Forging Press and Steam Hammer Comparison

The press possesses many advantages over the hammer in its effect on the material, in the manipulation of the forging, in output and economy in working, and in absence of noise and vibration, which, in the case of heavy hammers, is always objectionable, and often detrimental to adjacent buildings and machinery.

Effect on the Material

Dealing first with the effect on the material, the squeeze of the press penetrates to the centre of the forging, as is evidenced by the bulging of the sides of the forging at each stroke; whereas the blow of the hammer has much more of a surface effect, often leaving the sides of the forging quite concave unless the power of the hammer is very ample. As a result of this difference of action, the hammered forging shows a slightly finer texture on the surface, but a distinctly mor open grain of metal towards the centre. The pressed forging, on the other hand, shows a fairly fine and practically uniform texture throughout the entire section.

Individual tests may not always show a very marked difference between pressed and hammered forgings, because a good deal depends on the relative powers of press and hammer to the size of the forging, the temperature at which the work is done, and the subsequent annealing or heat treatment; but in the course of the regular manufacture of tires, for example, it has been found that much better and more reliable tests have been obtained from the press than from the hammer. This advantage of the press is recognized by Government requirements for forgings which stipulate that, for rolled or hammered steel, the ingot must have an initial section eight times the finished section, whereas those pressed need have an initial section of four times only.

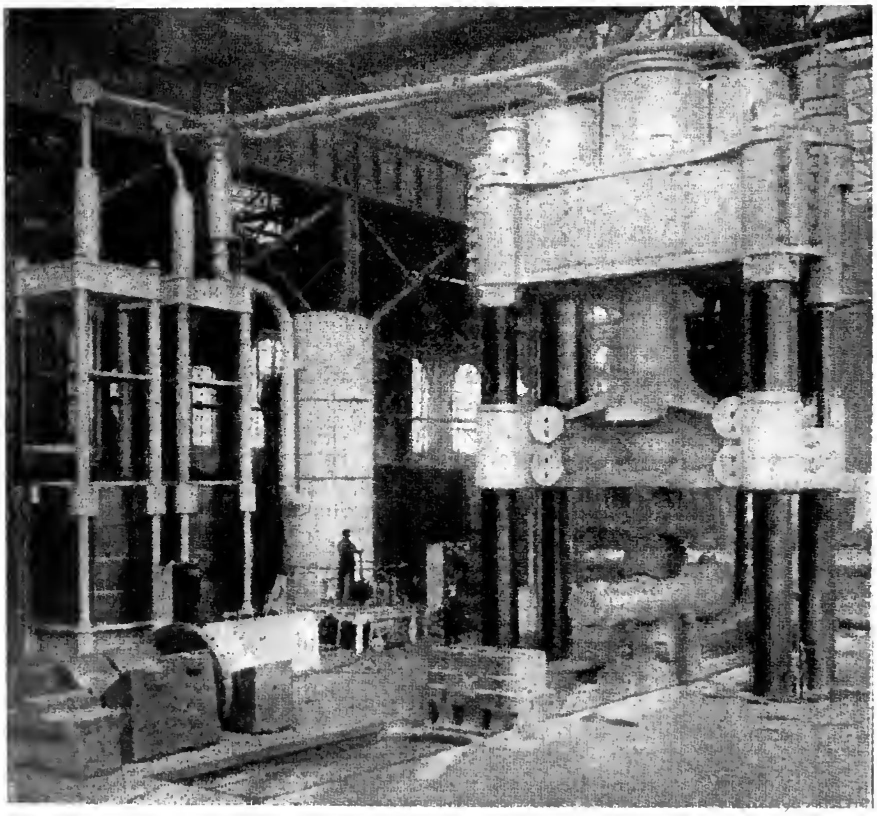


FIG. 1. MODERN FORGING PRESS OF 6,000 TONS CAPACITY.

Manipulation of the Forging

For the expeditious and accurate manufacture of forgings, a great deal depends on the ease and convenience with which the forging itself and the tools required for its production can be handled; and comparing the action of a press with the blow of a hammer, it will be readily understood that the advantage in these respects is entirely on the side of the press. In the first place, it is essential in working under a hammer that the forging should lie true on the anvil, otherwise a fair blow can-

not be struck, and an objectionable shock may be caused to the crane carrying the forging, and perhaps also to the men who are manipulating it; whereas a press will bring the forging to its correct position on the anvil without causing any jar and without interfering with the effect of the forging stroke.

When using tools under a hammer, much greater care must be used to place them correctly and to hold them in position, because the repeated blows of the hammer tend to displace them. A press on the other hand, once the tool is correctly placed, holds it in position until the cutting or forging stroke is completed. This enables such work as cutting or necking to be done much more easily and accurately under a press than under a hammer. For making a tapered forging with a press, a wedge-shaped block to give the correct taper can be laid on the anvil without any fixing. With a hammer, such an arrangement would require fixing to prevent its being displaced.

To forge accurately to size with large presses, a scale or indicator-dial can be used, worked from the cross-head, which enables the operator to read the reduction made at each stroke and to work the forging down to the finished size without any measuring. With small presses, a gauge piece is often used between the tool-faces which enables the forging to be made exact to size. With a hammer neither of these methods can be used conveniently.

Output

In almost all classes of work the press has a great advantage over the hammer in the matter of output. The blow of the hammer produces a very limited effect, generally reducing the forging by only the fraction of an inch, whereas the press will make a reduction of several inches per stroke, which, in straightforward cogging or rough forging work, naturally increases the output enormously. A good modern forging-press of 2000 tons will make as much as twenty 3-in. (75-mm.) strokes, or a total penetration or reduction of the forging of 60 in. (1,500 mm.) per minute. In rounding up or finishing a forging, such a press will work up to 60 strokes a minute, so that it is as fast as a hammer in finishing, and much superior to a hammer in cogging and rough forging.

As an instance of the output obtainable with a modern quick-acting press, a 2000-ton press of the steam intensifier type, starting with a 45-in. (1.143 m.) ingot, has cogged down and finished a 30-ft. (9-m.) length of well-finished 15-in. (381-mm.) shaft in one heat, using only flat tools. With a hammer of equivalent power, this work would have required not less than three heats. As another instance, a 1000-ton press, working on 24- in. (600-mm.) ingots, has forged 31 tons of 15-in. (375-mm.) round shafts in eight hours, and as much as 34 tons of miscellaneous forgings have been produced in eight hours by the same press. These are undoubtedly performances which could not be approached by any hammer.

With forgings of a more intricate shape, the advantages of a quick-acting press over a hammer are even more marked, because the same advantage in speed of penetration is obtained combined with much greater facility in handling the forging and, at the same time, the production of a forging more accurate to shape and size. As an instance, an 800-ton press, which is nominally equivalent to a 7-ton hammer, has produced the forgings for an anchor weighing 11 tons in three days. Properly, this size of work should have been done under a press of 1,200 tons, which could have cut the time occupied to about one-half.

Hollow forging is another class of work for which the press is much better adapted than the hammer. This is particularly the case in expanding operations for making hoops or drums, because the mandrel and its supports stand up far better against the squeeze of the press than against the blow of the hammer, resulting in more expeditious and better work.

Economy in Working

The principal factor in economy in working is the much larger amount of work that can be done in a heat under a good quick-acting press than under a hammer, as there is not only the actual saving in time, but considerably fewer heats are required to produce the same weight of forgings, and consequently the expenditure in fuel in reheating is greatly reduced. Besides this, the steam consumption of a good modern press is barely half that of a hammer for the same output.

Actual results over extended periods with presses have shown that in the production of solid, heavy forgings, such as shafts, the consumption of coal for steam production averages 3 cwt. (150 kg.) per ton of forgings; but for general work the consumption may be taken at from 3 cwt. to 5 cwt. (150 kg. to 250 kg.) per ton. It is evident that with a hammer a great deal of useful work is lost in vibrations; and in a paper on "Power Forging," with special reference to forging-presses, by Gerdau and Mesta, published in the Journal of the American Engineer, July, 1911, it is assumed that this loss amounts to one-third of the useful work, which is probably not over the mark. A calculation by the same authors gives the following results for equivalent powers of hammer and press:

Steam hammer, per stroke, 8 lb. (3.73 kg.) steam.

Steam, hydraulic press, per stroke, 3.7 lb. (1.68 kg.) steam.

An exact comparision is difficult to obtain; but the statement made above—that the steam consumption of a good modern press is barely half that of a hammer under average working conditions—is probably well within the mark.

When coal-fired furnaces are used for heating the forgings, it is often possible by means of the waste heat from the furnaces to raise sufficient steam for working the press. This is generally more convenient and economical than using gas-fired heating furnaces and independently-fired boilers.

Absence of Noise and Vibration

The press, with its silent working and absence of vibration, contrasts very favorably with the hammer, which causes much inconvenience and often considerable detriment to adjacent furnaces and buildings and to the working of any machine-tools in its vicinity. In many cases the inconvenience caused by hammers to adjacent establishments has been so great that, on this account, it has been necessary to replace them by presses. Besides this, the foundation required for the press is very small and inexpensive compared with what is required for a hammer; and when the nature of the soil is unfavorable, this difference is accentuated. The working of the press is also much less detrimental to the tools which can often be of cheaper construction and require less frequent renewals.

Capacity of Press and Equivalent Power of Hammer

The following table, which gives the maximum diameter of ingot that each power of press is capable of dealing with effectively and the equivalent power of steam-hammer, will be of assistance in making a comparison of the two methods of forging:—

Ingot Diameter In.	Ingot Diameter mm.	Press Power tons	Hammer Power tons
5	123	100	0.50
6	150	150	0.75
8	200	200	1.00
10	250	300	2.00
12	300	400	3.00
14	350	500	4.00
16	400	600	5.00
20	500	800	7.00
24	600	1000	10.00
30	750	1200	15.00
36	900	1500	20.00
48	1200	2000	40.00
60	1500	3000	80.00
72	1800	4000	120.00
84	2100	5000	—
96	2400	6000	—

From this table it will be seen that the power of the press bears a fairly direct proportion to the diameter of the ingot, but the power of the hammer required increases much more rapidly, being nearly proportional to the square of the diameter or the sectional area of the in-

got. For instance, for an ingot 24 in. (600 mm.) in diameter, the power of press is 1,000 tons, and the hammer 10 tons; but for a 48-in (1,200 mm.) ingot, the power of press is 2,000 tons, and the corresponding hammer 40 tons, and. consequently, the heavier the work the greater is the advantage of the press over the hammer.

As stated above, for the heavier classes of work, presses have been used in many of the principal steel works for as long as thirty years, the power of such presses most generally used, up to twenty years ago, being from 2,000 to 3,000 tons, though during this period some much more powerful presses, up to 10,000 tons, have been put down for forging armor plates and for special purposes. During the next ten years—that is, up to ten years ago—owing to the increased size of guns and other forgings required, a good many presses of 4,000 tons have been adopted.

During the last ten years—that is up to the present date—owing to the further increase in the size of guns, and also to the larger forgings required for marine work, particularly turbine-drums and spindles, the power of press required has increased correspondingly, 6,000 tons being the power most recently adopted for the heaviest work of this class.

Method of Driving Press

To explain the development in the use of the press, some mention must be made of the improvements that have been introduced in the method of driving. The earlier forging-presses have generally been driven by means of pumping-engines working direct into the press cylinders, the working pressure being usually from 2½ to 3 tons per sq. in. (400 km. to 480 km. per sq. cm.). For large presses this method gives satisfactory results, but it has never been used to any extent for presses of medium or small power, for which greater simplicity and a higher speed of working, especially in finishing, are more essential.

Another method is to make the press purely hydraulic, working it from an accumulator. For certain special work, such as piercing projectiles or billets for tube-making, in which a long stroke without any pause is desirable, this system is undoubtedly the best. For ordinary forging operations, however, for which a short, rapid stroke is essential, this system has only been adopted to a limited extent and is applicable only to presses of comparatively small power.

The system that fulfils the requirements of forging best is the steam, hydraulic intensifier. For a good many years it has been used to some extent, but it is only within the last ten years that it has come into general use and been adopted extensively for presses of small and medium power as well as for the heaviest forging-presses. The advantages of the steam-intensifier presses are that, in its latest and best form, it is capable of fulfilling adequately all the requirements of forging.

These include sufficient rapidity of action in all its movements—that is, the idle stroke when lifting the press-head and bringing it down to its work and the forging stroke or penetration. The idle stroke should be from 6 in. to 12 in. (152 mm. to 305 mm.) a second, according to the power of the press and the nature of the work, and the forging stroke up to 3 in. (76 mm.) per second, according to the resistance of the forging. Also there should be no pause or dwell either when the tool first touches the work—that is, before the forging stroke commences— or at the end of the forging stroke; that is to say, the return stroke should commence directly the penetration is completed, any pause causing loss of time as well as chilling the forging. The length of the forging stroke is usually from 1 in. (25 mm.) up to 6 in. (150 mm.), or 8 in. (200 mm.) in the case of very large presses and the speed of such forging from 10 up to 50 strokes a minute, a total penetration of 60 in. (1,500 mm.) a minute being obtainable when the power of the press is well up to its work and the forging handled expeditiously.

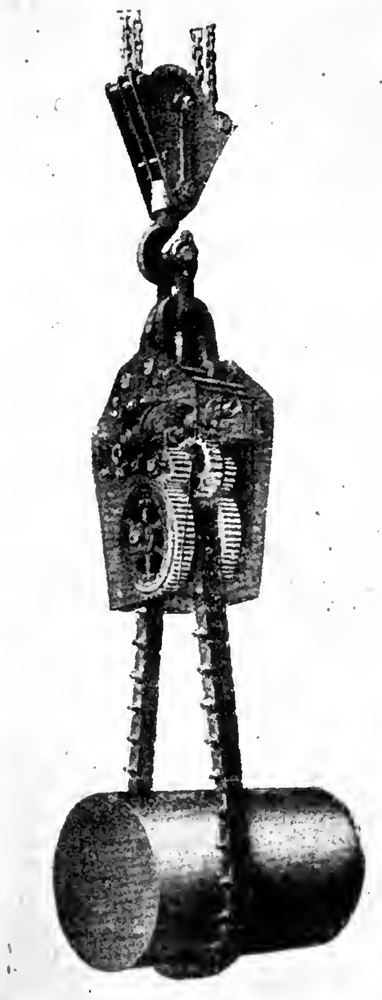


FIG. 2. ELECTRICALLY-DRIVEN TURNING GEAR FOR ROTATING FORGINGS.

For rounding or finishing a forging, a very rapid stroke is desirable; a good intensifier press of as much as 6,000 tons being capable of working up to 40 strokes a minute, and smaller presses proportionately quicker up to 100 strokes a minute. With these speeds of working an efficient control-gear is desirable both to limit the forging stroke and also to prevent any overrunning of the intensifier in case the load on the press is suddenly removed, owing to the forging or tool slipping or other accidental cause. So successfully has efficient control-gear been applied to intensifier presses that they can be worked quite safely and easily at the high speeds mentioned. Presses already constructed on this system range from 100 up to 6,000 tons power, the larger presses giving proportionally equally as good results both in forging and in rapid finishing strokes.

Forging Operations

Fig. 1 illustrates an up-to-date forging-press of 6,000 tons power, engaged in forging a solid shaft. This press is driven by two intensifiers, arranged to work simultaneously or independently by means of catches on the handing-lever. Working simultaneously, the intensifiers give a forging stroke of 10 in. (250 mm.) and a speed of from six to ten strokes a minute, according to the penetration required. When short strokes for finishing are required, either intensifier can be used and the press can be worked up to forty strokes per minute.

The full equipment for such a press, to enable it to deal advantageously with the various classes of work, includes the following:—

Mandrel-gear, giving the mandrel-blocks a travel of about 30 ft. (9 m.) on each side of the press.

An extended base of sufficient strength so that the full power of the press can be exerted on the mandrel-blocks when they are spaced at the maximum distance apart required for expanding work, such as turbine-drums or gun-jackets.

Manipulating gear for handling forgings without the use of a crane:—this is particularly useful for certain classes of work, such as forging armor-plate and turbine-wheels, and also in some cases for cogging ingots.

Transverse tool-changing gear:—this is useful for forging crank shafts and similar work when it is desirable to change from flat tools to V-shaped or swaging tools. The gear enables both top and bottom tools to be changed very

quickly without taking the forging from under the press.

Turning-gear for rotating the forging:—The most convenient form is a self-contained electrically-driven gear, suspended from the crane-hook. Fig. 2 illustrates such a gear. Preferably this should be provided with a friction-clutch which slips during the instant that the press grips the forging.

A press with the above equipment is suitable for practically all classes of heavy work. Examples of forgings made under such a press will be given in the continuation of the present article next week.

OPEN-HEARTH VS. ELECTRIC FURNACE FOR COMMERCIAL STEELS

THE fundamental question is one of cost, and any authentic figures are always welcomed as throwing fresh light on this subject, which is of great commercial interest. The fact that the electric furnace can successfully compete with the crucible process, and in some cases with the small converter, is, we think, established, but a comparison of the electric furnace with modern open-hearth furnace is open to discussion, and is made the subject of an article by S. Cornell in a recent issue of the Metallurgical and Chemical Engineering.

In order to provide data on this point a table has been compiled for a year's operation of a large open-hearth plant and compared with what is claimed to be practice obtainable in an electric furnace plant of the same capacity. The open-hearth plant consisted of 80-ton furnaces, having a production of 200 tons of ingots per day for each furnace, compared with 20-ton electric furnaces, approximately the same capacity per day.

Dealing with the materials necessary to make one ton of steel, and including all consumable material and cost of repairs, it is calculated that the cost per ton of steel is $14.50 for the open-hearth against $18 for the electric steel. The cost and quantity of raw material is taken to be the same in both cases, and the difference is due entirely to a fuel cost for producer gas being 54 cents for the open-hearth, as against $4.40 for electric power in the electric furnace.

The general labor charges which are common to both processes is worked out at $1 per ton of steel, whilst the cost of general repairs is given as 6 cents per ton.

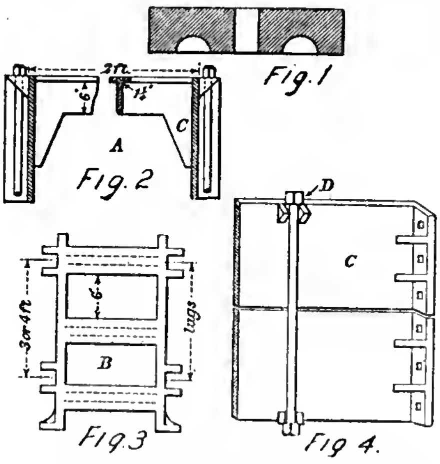
From a careful consideration of the outlay necessary in installing electric furnaces of sufficient capacity to produce the same tonnage as a set of open-hearth furnaces, it is calculated that in order to compete in cost the electrical energy must be produced at below 1 cent per kilowatt-hour.

The present electrical equipment using blast furnace gas cannot do better than 7 cents per kilowatt-hour.

HINTS TO FOUNDRYMEN

A CONTRIBUTOR to "Engineering" says it appears to be general practice to make patterns for all classes of castings, light or heavy, and to ignore loam work as being either too costly or causing too much dirt in the shops. This is entirely wrong, as I think some of those in charge have but little knowledge of how loam work can be made to advantage over sand, both as regards cost and keeping the shop just as clean.

I was talking to a gentleman the other day, who thought that his was quite a modern concern. They were engaged on one class of engine, etc., or what might be called repetition work. There was one casting in particular being made from patterns; this was what molders commonly call a block fly-wheel,



ILLUSTRATING HINTS TO FOUNDRYMEN.

up to 12 ft. in diameter, as shown in sketch (Fig. 1). Now to make such castings as these in sand is not only increasing the cost, but causing a lot of unnecessary hand labor for the molders.

Anyone that claims to know anything of modern foundry practice could take 10 per cent. from the cost of a casting of this kind by making it in loam, and more than another 10 per cent. from all others that were required. There is plenty of room yet for green, dry sand and loam work in a modern foundry, and castings can only be produced economically by sound judgment in the use of them.

Jobbing Foundry-Box Parts

The writer has worked in plenty of jobbing foundries doing a fairly decent class of work that could be cast on its joint, but if anything came along that had to be cast vertical, it had to be rejected as being something out of their particular line. Now if the boxes had been made to tackle any class of work, such castings as hydraulic bodies, rams, etc., could have been made.

All that is required is a crane of sufficient height to turn them up, to make the bars in the box with lips as shown in the sketch (Fig. 2) like a T, and to place lugs (Fig. 3) at the back about 3 ft. or 4 ft. apart, for the boxes to be bolted with these when they are being used vertically. A cross-section of the box is shown at A; the top and distance of the bars should be apart are indicated at B, while C shows a side view of a pair of boxes, and D the bolts and method of fastening. These can be made in lengths to the requirements of the foundry; 6 ft. and 9 ft. are fairly handy. The boxes can be bolted at the ends to make any length required; they are perfectly safe, no plating or the back of the bars or ramming being required.

Splitting Castings

The best method of treating splitting plates for castings is to glue a thin layer of asbestos over them; when cast they will rap out, leaving a smooth, clean face.

LARGE SHELLS: PRODUCTION PROBLEMS AND POSSIBILITIES.—V.

(Continued from page 545.)

meter of the inside of the pulley, and is of the taper cork insert type. It is operated by a separate valve and the release is by springs. The thrust of the spindle is taken at the forward end bearing, a take-up collar being provided at the rear of the same bearing.

The tool base is bolted firmly to the bed and carries both roughing and finishing heads. On the 9.2 in. the roughing is split into two operations. Each tool is fully adjustable, but when once set, they can be removed and replaced with precision. The feed of both tools is by a single screw to positive stops. The undercutting tool is on a separate block mounted on the front slide at the correct angle and is fully adjustable. The feed is through lever and cam. The rear or finishing tool is so mounted that the tool slides past the band and shears it to the exact size and shape. The tool block is securely bolted to the base, but is slightly adjustable to and from the cut. It can also be rotated if necessary, so the tool will cut both ends of the band to correct size. The feed is by rack and pinion, with handle in a convenient position for the operator.

Two roller supports are provided on the bed so that the shell can be lowered by an air hoist or other means into the chuck, and in line with the centre. The rollers are not in contact with the shell when it is rotating.

EDITORIAL CORRESPONDENCE

Embracing the Further Discussion of Previously Published Articles, Inquiries for General Information, Observations and Suggestions. Your Co-operation is Invited

GALVANIZING CONDUITS

THE manufacture of galvanized conduits at the plant of the Orpen Conduit Co., Toronto, Ont., presents several interesting features, the principal one being that the pipe is copper-plated before being galvanized. Copper-plating is a protective covering of great value in resisting corrosion, forming an ideal "couple" between the metal of the tube and the zinc. The zinc is, therefore, deposited on copper and not on iron by means of the electro-deposition process, thus its full value as a rust preventative is secured.

This conduit, which bears the trade name of "Xceladuct," is a high-grade mild steel butt-weld pipe of special quality, being heavier than ordinary tubing. The pipe for the straight conduit is received at the factory in 10-ft. lengths, and is made in Canada; the bends are, of course, shorter. The pipe is threaded at both ends, one end having a coupling when shipped. The conduit is made in sizes from ½ in. to 6 in. inclusive.

Pickling Process

The first process consists of pickling, which is done to remove the scale, etc., from the pipe. For this process there are installed a number of wood tanks, the first containing a potash solution for removing oil or grease from the pipe. The pipes are then dipped in a tank containing sulphuric acid, which removes the scale. They are then dipped in another tank containing muriatic acid, which gives a smooth surface to the pipe.

On the completion of the foregoing, the pipes are laid out on a flat table, where they are carefully inspected. A powerful light at one end enables an examination of the inside to be made. Any defective pipes are laid to one side, and the sound ones are taken over to the plating department.

Plating and Galvanizing

In the plating department are installed a series of five tanks in one row, each being 14 feet deep, and having a capacity of 4,000 gallons. The tanks sit in an asphalt pit, and are constructed of wood or steel, according to the character of solution which they contain. Before being dipped in the first tank, the pipes are assembled in a "basket," in which they are held until this process is completed. The basket is made of copper, and is constructed so as to hold the pipes vertically. It has a capacity for 175 lengths, each 10 ft. long, of ½-in. pipe, equivalent to 1,750 ft. The larger sizes, being heavier, fewer pipes are dipped at one operation.

The basket is suspended from and carried along by means of an electrically-operated hoist on an overhead runway, extending the full length of the tank. At the end of the operation, when empty, the baskets are returned on an overhead runway at each side of the tank. The hoist has lifting and lowering motions for use when dipping the pipes.

The pipes are dipped in three different solutions before being copper-plated. After being in the copper-plating tank the prescribed length of time, they are taken out and dipped in the zinc tank, where they remain about 45 minutes. They are then taken out and put in the rinsing tank.

The electrical equipment for the zinc and copper tanks consists of two motor-driven plating dynamos. One unit consists of a Canadian Hanson & Van Winkle Co. plating dynamo, 8,000 amperes, 6 volts., direct-connected to an 85 h.p. C.G.E. motor running at 470 r.p.m. The other unit is of the same make and size, but belt-driven by an 80 h.p. C.G.E. motor. The wiring from the dynamo is taken under the floor, up the outside of the tank, and connected to the anodes.

Drying and Insulating

After the pipes have been rinsed, they are taken from the basket and placed vertically over a grating through which air is passing from a blower. The pipes are thus thoroughly dried before being insulated and again inspected. For the insulating or enameling process, the pipes are laid inclined on a table and the enamel flows from an overhead tank through them into a shallow tank, whence it is pumped back by means of a motor-driven rotary pump to the overhead tank. The pipes are then placed vertically over a grating to dry, a current of air passing through accomplishes this.

They next go to the labeling table, where they are laid flat and two labels affixed—one factory label and one for the Underwriters. At this stage the pipes are carefully examined by the Underwriters' inspector, who selects one from each batch to be tested. Before leaving the table, a coupling is screwed on one end of each pipe, after which they are tied in bundles ready for shipping. The test pipe is cut in two sections on a hack saw machine, and a length taken to the inspector's office, where it is tested to ascertain if the zinc coating and enamel are adhering in a satisfactory manner. The tests are very thorough, as the conduit must conform in all respects to Underwriters' rules.

Elbows

The above-mentioned processes cover the straight lengths of conduit only. The elbows are treated in a somewhat indifferent way, chiefly as regards handling. Short lengths of pipe are received at the factory, threaded at both ends. The first requirement is to bend them to the required angle and radius. For the larger pipes a belt-driven bending machine operated from the line shaft is used, while the smaller size pipes are bent in a steam-operated machine. In both cases different forms are used to suit the various sizes of pipe.

The elbows, as in the case of the straight pipes, undergo the pickling process and in the same set of tanks. The elbows are, however, scrubbed with sand after being pickled. They are then copper-plated in the same tank as the straight lengths, but have a separate tank for the galvanizing process. The current for the zinc tank is furnished by a plating dynamo, which is also connected to the zinc tumbling tank used for galvanizing the couplings. The dynamo supplies current at 6 volts, 400 amperes. After being galvanized, which takes about 30 minutes, the elbows are taken out and hung on a rack to dry, and then taken over to the insulating tank to be enameled inside. After being enameled, they are hung on racks to dry, and are then inspected and stamped the same as the straight conduit. The elbows are also inspected and tested between the various processes. All sizes are treated in the same way.

Couplings

As already stated, a coupling is supplied with each length of conduit. The first process consists of pickling, which is done in the same set of tanks as the pipe and elbows. They are also copper-plated in the same tank, and are held in wire baskets during the process. For galvanizing, there is a special tumbling tank installed, in which the couplings are revolved for three hours. When the galvanizing process is completed, the couplings are taken out and washed in cold water. They are then put in wire baskets, washed again in hot water, and afterwards laid on a wire screen to dry. They are afterwards taken to the store room to be used as required.

CHUCKS VERSUS FIXTURES

By D. A. Hampson.

ALMOST every part that is made in quantities of one hundred or more requires some sort of fixtures if the work is to be done cheaply and the parts have to be at all interchangeable. The commercial side should determine how elaborate these fixtures are to be; but before going to the expense of making or even of designing them, it is well to take account of stock and see if there are no standard adjustable fixtures which can be used instead.

Into this class come chucks,

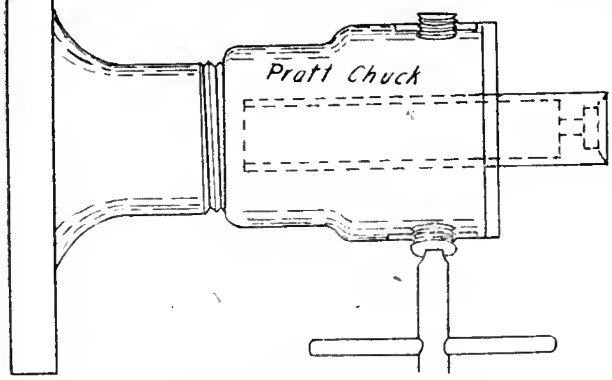
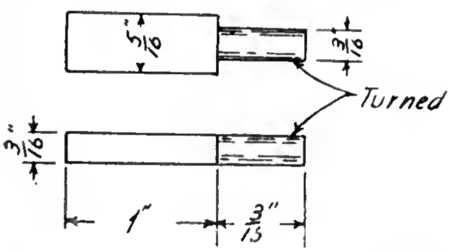


FIG. I. CHUCKS vs. FIXTURES.

drill heads, jigs, vises, etc. On work that is to last but a few days or a few weeks, such tools can be made to show almost as great a production as specially made-up tools, and show a nice saving in initial expense and ultimate discarding. Two cases in which ordinary drill chucks were used to advantage will be reviewed.

Ten thousand brass shells were to have an 1/8-inch hole drilled through the end. Instead of making a special holder for these, a Pratt drill chuck of the familiar two-jawed type was selected from among the "spares" and a cast iron base made to support it. The drawing shows this and also the wrench for opening and closing, the wrench being made a tight fit in the socket, so it is always in place. A quicker or more satisfactory



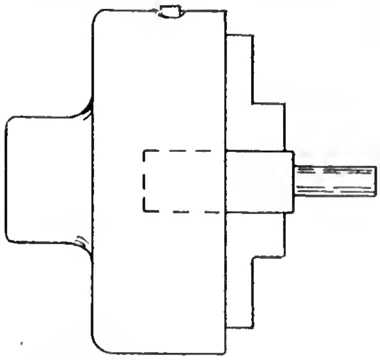


FIG. 2. CHUCKS vs. FIXTURES.

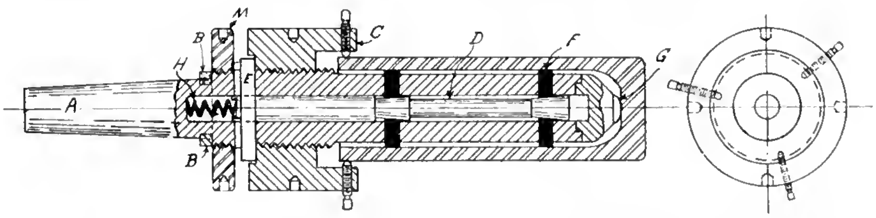
fixture would have been impossible to make, and when the job was done we had not added as much as a dollar to the obsolete tool account.

A "trial lot" of a new mechanics' tool required a thousand pieces of 3-16 x 5-16 drawn steel, with a symmetrically turned stem at one end. There was in the tool room a nearly new two-inch, two-jawed Cushman drill chuck. To this we fitted a shank that was fitted to the "centre" taper of a lathe spindle. The jaws of the chuck being V-shaped, formed a perfect driving and centering medium. After milling the pieces to length, they were turned in the chuck, suitable stops having been arranged for position, length and diameter. It is doubtful if any special fixture would have done the work more accurately—it is certain that they would not have paid on a quantity of this size.

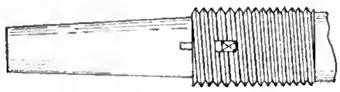
EXPANDING MANDREL

By G. Barrett

THE expanding mandrel is undoubtedly one of the most called-for tools required in the manufacture of shells, and its use has never been so widespread as it is at the present time. The one which we illustrate herewith was designed for a lathe which had been temporarily out of commission owing to the lack of a hollow spindle.



AN EXPANDING MANDREL.



The end of the mandrel A is fitted to the tapered hole in the lathe spindle and is prevented from turning by means of the pins B which engage with two corresponding slots in the spindle nose.

In operation the shell is first placed over the mandrel till it touches the point G. The nut C is then tightened against the cotter F, causing it to draw up the rod D, the inner end of which projects into the hole H. By this means the tapered diameters on the rod D force the dogs F outward against the shell. By tightening the three set-screws shown in the nut, a firm grip is assured, since the strain of the cut will have the tendency to still further tighten the nut.

To remove the shell the set-screws are slackened off and the nut C is screwed back. A slight pressure is then applied to the cotter E by means of the nut M. This forces the rod back and relieves the strain on the dogs sufficiently to allow the spring H to force the rod back the remaining distance and thus release the shell.

TRADE WITH BRITAIN

AN increase in Canadian trade with Great Britain, particularly in exports, is shown in British trade returns for the nine months of the present fiscal year ending October 31st last, which have reached the Trade and Commerce Department. The 1915 figures of Canadian trade for this three-quarter period were $188,824,340, as compared with $174,000,000 in 1914. Of the former total, over $138,500,000 was in Canadian exports. Canada's trade was considerably less than Australia's, which totalled $300,000,000, probably due to the purchase of war munitions. Great Britain's trade with the United States increased by about $350,000,000. The October figures also show a decrease in the disproportion evident between British imports and exports since the war. From this, the inference is drawn that the English people are beginning to economize by cutting down consumption of all but necessities.

Truing an Oilstone.—To true an oilstone, the Mechanical World suggests the following method:—Take a piece of soft pine board of any thickness, about 8 in. wide and 3 ft. or 4 ft. long. Lay it on a bench and fasten it with a handscrew or other clamp. Put on some clean, sharp sand, screened about as fine as that used for plaster work. Use no water, and rub the stone back and forth over the board in sand. This will give a flat surface to the stone in a short time. Care should be taken to move the stone on straight lines, so as not to give it a warped surface. If a fine surface is wanted, a finer grade of sand or sandpaper may be used to finish with.

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Machine, Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

GRINDING ENDS OF SHELLS

AT the square end of a shrapnel shell there is a small turning hub or centre projection which has to be removed before the shell is completed. There are various ways of removing this stock, but production is the essential factor in all. The Gardner Machine Co., Beloit, Wis., has developed a special grinding machine for this operation,

This equipment is also used for cutting off the square or angular hubs from base plates in high explosive shells as well as on shrapnel casings. From a grinding standpoint, the operation is the same in both cases. In some instances the hub is removed by some other process and the riveting done. It is then placed on the grinder and the balance of the base plate is removed, taking a light cut over the entire base of the shell as well.

The machine consists in the main of a very heavy base casting, with a 2-in. diameter spindle, mounted in either high-grade babbitt bearings or ball bearings. On each end of the spindle is mounted a "Perfection" ring wheel chuck, of improved design. These chucks contain 16-in. diameter abrasive rings selected for these operations.

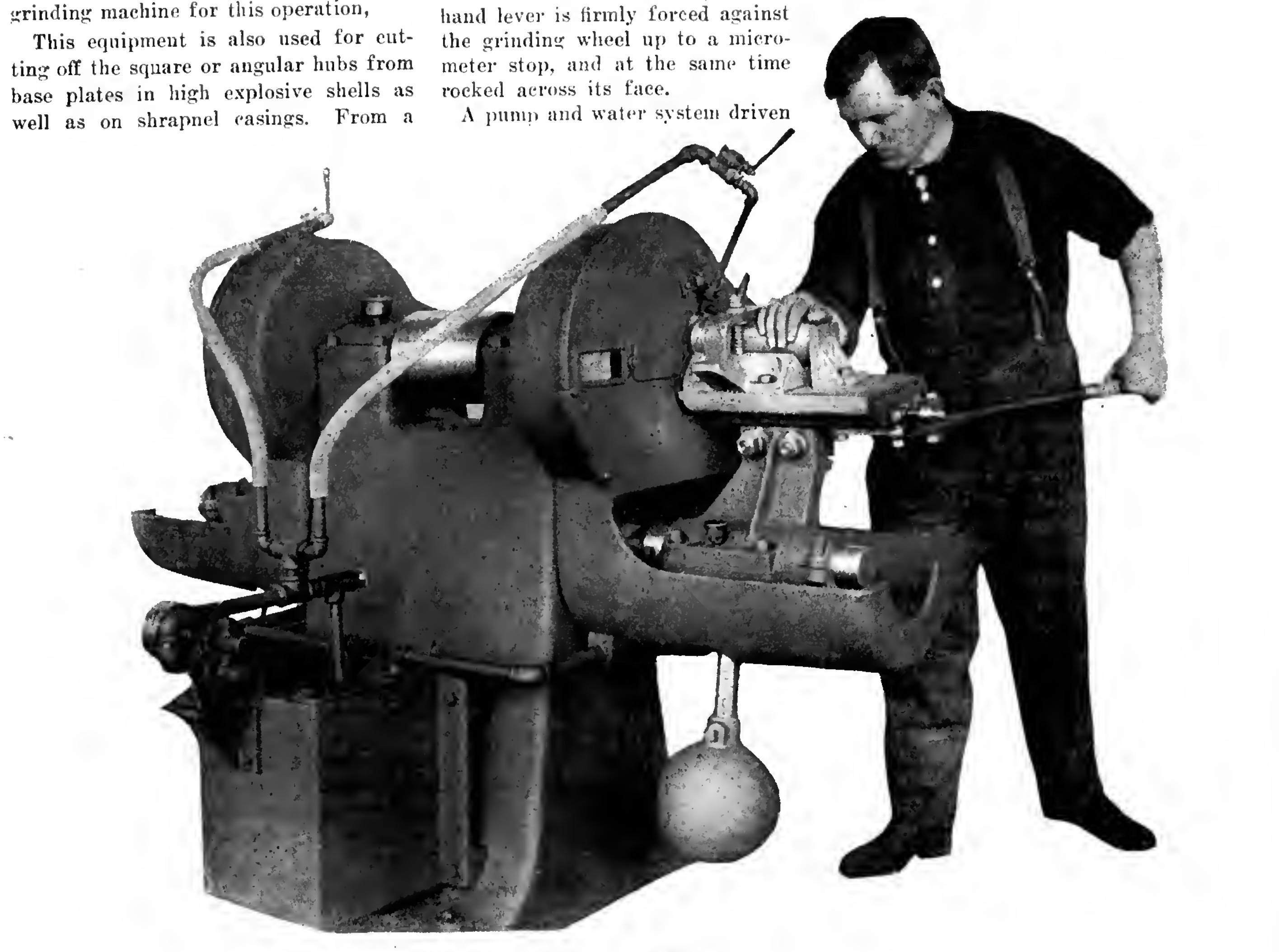
Lever feed work tables, supported on a rigid rocker-shaft running entirely through the base, serve the grinding wheels. The shell is quickly clamped into "V" fixture, and by means of a hand lever is firmly forced against the grinding wheel up to a micrometer stop, and at the same time rocked across its face.

A pump and water system driven from the counter-shaft directs the water or grinding compound at the point of grinding contact. The hoods and basin are one-piece castings.

The output obtained from one end of the machine varies according to the size of the projection to be removed, being from 40 to 100 per hour. This machine, with both ends equipped and operated by two men, gives double this output.

The complete equipment includes two 16 in. "Perfection" chucks, two 16 in. abrasive ring wheels, two semi-universal lever feed work tables, two shell-holding fixtures, water pump, with connections, countershaft and general supplies. The whole outfit weighs 4,000 pounds.

This firm also builds a No. 50 grinder, which is much heavier and more powerful than the one illustrated herewith, and which is also being adopted by manufacturers of 6-in. shells for these same operations.



MACHINE FOR GRINDING BASES OF SHRAPNEL SHELLS.

DIAL FEED ATTACHMENT FOR LARGE SHELLS

THE Ferracute Machine Co. of Bridgeton, N.J., has recently developed an automatic dial feed attachment for use in cupping and re-drawing cartridge cases and other sheet-metal shells, the attachment being used in connection with straight-sided presses exerting pressures from 100 to 200 tons.

The illustration shows a 100-ton press fitted with one of these attachments, the dial having six recesses, it being essen-

tial that a recesss be in alignment with the centre of ram as it descends to insure the entrance of the punch in the partially drawn shell. Pressure on the treadle will cause the press to stop instantly at any portion of its stroke.

The dial has an intermittent motion, being at rest while the press makes a stroke. A cam on the main shaft gives motion to the rack that partially revolves the dial yoke. An additional cam on the main shaft operates the "lock" mechanism. This lock is a lever containing a wedge-shaped end that fits each of the six notches in the circumference of the dial.

Connected to the lock mechanism is an "interrupter." When the lock is in a notch, indicating that the ram and dial-recess are properly aligned, the interrupter prevents a weighted rod from descending, but if by any mischance the lock should fail to enter its notch, the interrupter will change its position, allowing the weighted rod to descend and depress the treadle, causing the press to instantly stop, and thereby avert damage. After cause of trouble has been ascertained and adjustment of dial finished, the press may be made to complete its stroke by pulling down the handle-strap, the ascending ram elevating the weighted rod, and the treadle and treadle-rod assuming their first position.

The press is equipped with a combined friction clutch and brake. Pulling down the hand-lever connects the power to the shaft, giving motion to the press, while depressing the treadle releases the clutch and applies the brake. The machine is, therefore, under perfect control at any position of its stroke.

There are several adjustments that give accuracy to the motion of the dial. For instance, the amount of rotation of the dial may be regulated by means of a roller at top of yoke, set-screws being provided to give exact position. The motion is also controlled by a brake which is automatically released during the locking process. There is an eccentric adjustment which provides for the accurate relation between the lock and its notch, the tension of the lock being regulated by means of an adjusting spring.

Although designed primarily for continuous action, the press with its attachment can be used intermittently, that is, automatically stopping at the end of each stroke. When running continuously, 12 shells per minute are produced.

1,000-TON HYDRAULIC CARTRIDGE CASE HEADING PRESS

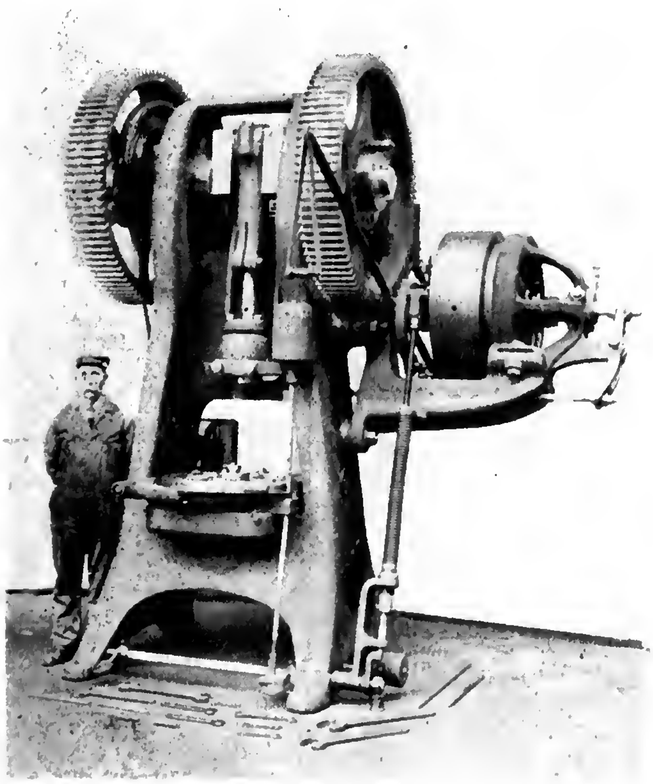
THE hydraulic press, illustrated, was designed for the heading of brass shells after they have been indented. The heading operation is accomplished by inserting a fullering block between the head of the press and the top of the cartridge case, the latter being held in place by a suitable die. As the pressure is applied, the fullering block causes the brass to flow outward in all directions, thus forming the head of the shell.

The press has a revolving turret with dies to receive three shells. This provides for an almost continuous operation, as there is always one shell awaiting the heading operation and one shell being unloaded, while the other shell is undergoing the heading operation. The rotation of this turret is controlled by an indexing device, so that the shell is accurately held in place directly beneath the fullering block.

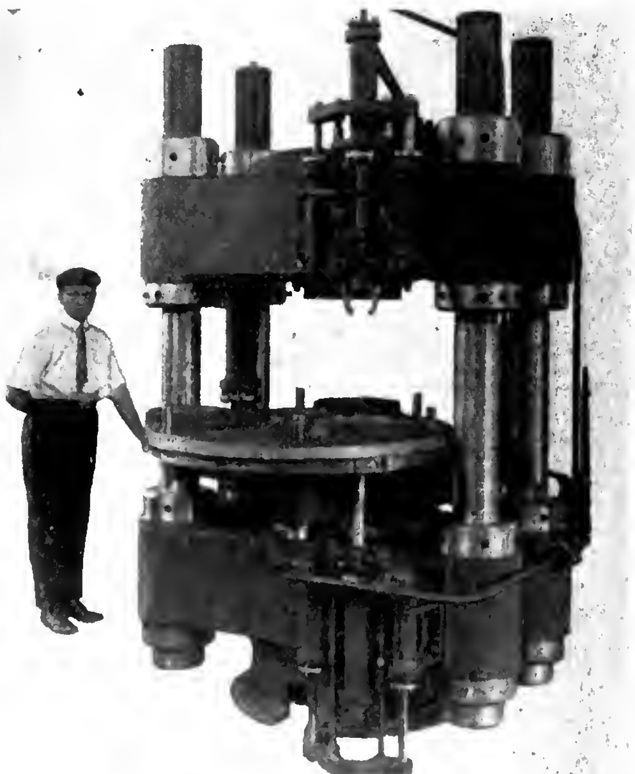
The indexing device is operated by a lever conveniently placed for the operator. By merely pulling the lever, the index latch is disengaged from the turret, clearing and releasing the turret for revolving. The photograph shows a rear view of the press. The lever controlling the indexing device is shown to the extreme right. The operating valve is entirely hidden by the press.

The turret revolves on a spindle mounted in ball bearings, which are set in the front side of the press between the strain rods. Handles placed around its outer edge at an equal distance apart are fitted for the purpose.

After the heading operation is completed, the shell is pulled from the die by an hydraulic ejecting device, which consists of two rams, one attached to the head of the press and the other to the base. Spring gripper jaws are attached to the upper ram for gripping the head of the shell. Each of these rams is provided with two auxiliary pull-back rams.



DIAL FEED ATTACHMENT FOR CUPPING AND RE-DRAWING CARTRIDGE CASES.



1,000-TON HYDRAULIC CARTRIDGE CASE HEADING PRESS.

The ram attached to the base of the press forces the shell up out of the die to a point where the gripper jaws on the upper ram can readily take hold of the newly-formed head. Pressure is then applied on the auxiliary rams for the return of the ejector rams. The finished shell is next removed from the gripper jaws of the upper ram and the device is ready for the next shell.

The use of two ejector rams, each working toward a common centre, makes the ejecting operation much more rapid and clears the turret in less time, so that it can be revolved more quickly for heading the next shell. The maximum pressure of the two ejector rams is 5 tons each.

The press is of steel construction throughout, the base and cylinder being cast in one piece. The ram has a diameter of 28 inches and a run of 12 inches. The press has an adjustable daylight of 30 to 45 inches.

The maximum total pressure capacity of the press is 1,000 tons, and the number of pressings per minute depends upon the capacity of the pump used for its operation. As a basis, the press will make 3½ pressings per minute with the pump furnishing 19¼ gallons of water per minute at a pressure of 3,250 pounds per square inch.

This projectile press is a new design and recent addition to those being built by the Hydraulic Press Mfg. Co., Mount Gilead, Ohio.

DOMINION ECONOMIC COMMISSION

AS a first step of the recently-appointed Federal Economic Commission, under Hon. J. A. Lougheed, towards securing working data from which to draw conclusions, a special census of Canadian industrial companies is to be taken. At the conclusion of the meeting held on Dec. 13 of the commission, R. H. Coates, Director of the Census and Statistics Branch, announced that a census of manufacturers would be taken by post next month. All manufacturers will be asked to fill out a census form, giving details as to capital invested, number of employees, wages, etc., and volume of production, distinguishing between war orders and general business.

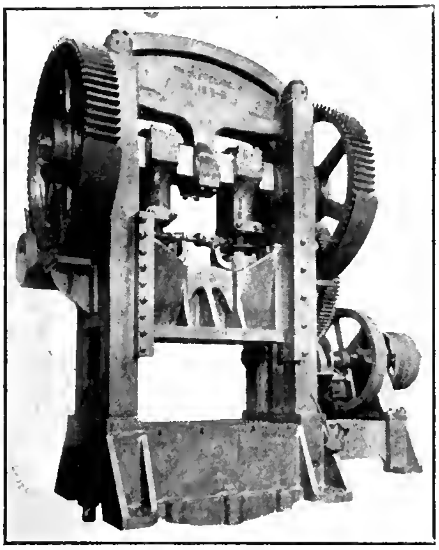
Efforts also will be made by the Commission to get the latest comprehensive and reliable information regarding agricultural production, including cost of production, market facilities, etc. In this connection the various agricultural associations will be asked to co-operate.

After the preliminary information sought is received, the Commission will visit various centres in sections and take public evidence as to needs, and recommendations looking to a better conservation of the national resources, and more economic methods of marketing, etc.

HIGH-DUTY POWER PRESS

FORCED production of automobile parts is creating a demand for stronger and heavier presses, with greatly increased factors of safety. The machine illustrated was recently developed by the Cleveland Machine & Mfg. Co., Cleveland, Ohio, for the production of automobile frame cross-bars and similar heavy forming, blanking and drawing.

A heavy spring drawing attachment (not shown) is mounted in bed of press, and is used for operating knock-out pads



HIGH DUTY POWER PRESS.

and drawing or pressure rings. The gearing is of steel throughout, with machine-cut teeth. The friction clutch is multiple disc type and very powerful.

The principal dimensions of the machine are as follows: Gross weight, 167,000 pounds; bed area, 72 in. R to L, x 48 in. F to B.; crank shaft, 10 in. diameter in bearings and 11¼ in. on crank pins; stroke of slide, 10 in.; distance bed to slide, stroke down and adjustment up, 26 in.; proportion of gearing, 45:1.

QUICK-FIRING GUNS

THE rapid development of artillery during the last few years has naturally led to the coining of a number of phrases to express the difference between the various types, and distinguish the new from the old and obsolete; while the rapid education of the general public in the elementary principles of modern warfare has brought some of these phrases into common use. It not infrequently happens that a whole series of remarkable improvements are designated for general use by a single expression. An excellent example of this is the term "quick-firing" as applied to modern gunnery.

Less than twenty years ago, it was recognized that the gradual development of the field gun had made so many changes necessary in the tactics of infantry that a radical improvement in the speed and accuracy of artillery fire was desirable. Men were no longer fighting in masses in the open, and they had found it more effective to offer only a fleeting target to the gun. Consequently the time required to load, run out, and aim the gun had to be reduced if the weapon was going to be of much use. Loading was enormously accelerated by the adoption of the single-acting breach mechanism, combined with a device for ejecting the empty cartridge case. The running in of the old gun to the firing position was necessary, because the recoil after firing was taken up by the gun and carriage as a whole. Hence, the weapon had to be run forward, set in position and re-aimed.

The Modern Gun

In the modern gun the barrel only moves, the energy of the recoil is taken up in an elastic press, and the barrel is returned to its original position by a spring. After firing, the modern gun returns instantly to the position it occupied before firing, and generally this does away with re-aiming. The improvements enumerated were first adopted by the French in 1897, and their famous 75-mm. gun can fire from twenty to twenty-five rounds per minute. Germany carried out an elaborate series of trials, extending over a long period, but it was only in 1905 that they adopted the quick-firing gun.

In the services the Maxims, Gatlings, and other automatic feed guns are not spoken of as quick-firers, that name being given to all weapons which are loaded by hand. Thus the 6-in. naval gun is a quick-firer and represents the maximum size of a quick-firing gun in the navy. The shell weighs 100 lbs., and can just be man-handled. The 7.5 in., the 9 in. and all heavier weapons are provided with regular hydraulic hoists and loading arrangements.

At the other end of the scale is the little 3-pounder, and from the 6-in. to the 3-pounder the firing arrangements are sensibly the same. Naval guns of greater than 6-in. calibre differ in the first instance from the 6-in. gun, in that the loading is done by machinery. With the main armament weapons of our battleships, the size and weight of the breech blocks renders it necessary to open and close the breech by hydraulic power; but the principle of the recoil arrangements is the same throughout.—Liverpool Journal of Commerce.

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PREPARING FOR COMMERCIAL ASCENDENCY

THE question of Canadian manufacturers being able to supply to the fullest extent possible, immediately the munitions demand subsides, our own domestic requirements and develop concurrently and maintain an export trade that will transcend in volume all previous achievement, is one that should be considered and given tangible expression to now by individual or collective organization. We have organized for munitions production in a manner that has merited world-wide commendation. We can also organize for these others just as effectively, and without hampering in the slightest degree the meantime munitions production efficiency.

Organization for the manufacture of munitions was largely an individual firm affair, and, the Department of Trade and Commerce, Ottawa, notwithstanding, similar action is inevitable if we would corall in large part our domestic business and establish a world-embracing export trade. Evidence is not lacking that preparation is proceeding apace in the United States and even in Great Britain to not only maintain but to take hold of every available opportunity, both domestic and foreign.

In the United States, the American International Corporation has been organized with a capital of $50,000,000, and with the most prominent of that country's financiers and business specialists behind it. The avowed intention is to prosecute the most vigorous foreign trade expansion campaign in American history.

In Great Britain, irrespective altogether of the duration of the war, it is expected that in a very short time with the completion of the many large and specially-equipped munitions factories, there will be a wholesale release of firms, large and small, meantime engaged in the production of war material. By way of anticipating this, the Imperial Government, through the Prime Minister and Chancellor of the Exchequer, has stated definitely that the maintenance of a large and increasing export business is one of the essentials if victory is to be complete.

Export trade on Britain's part is, even now, war work, and the immediate future is ear-marked for its diligent prosecution. By no other means can her resources be husbanded and her efforts be so thoroughly concentrated on the task she and her Allies have undertaken to bring to its logical conclusion than that of retaining the world-wide commerce and market for her wares already established, and by enlarging their scope and service.

We have already hinted at the almost certainty of Canada's efforts lacking official Governmental backing. Under such circumstances individual firm enterprise must needs be forthcoming. Efficiency engineers, safety experts, and a myriad other departmental appointments have come to be recognized as part and parcel of our leading metal-working and general manufacturing establishments. May we suggest that a domestic and foreign trade department is now also highly desirable, manned by experts in each particular sphere, who will organize campaign plans, collect data, and generally arrange easy transition from war to peace-time pursuits.

Men fitted to grapple successfully with the problems of shell-making were neither hard to "spot" nor to develop, and we are of opinion that their prototypes having both a sufficiently wide commercial experience and intimacy with the manufacturing or practical side of any factory product, will be likewise as promptly available and as prolific of achievement.

Our plants generally are in a position with the cessation of hostilities to compass a greatly increased and more diversified output. To secure business in the coming time, to maintain full employment for men and machines will, however, necessitate "rustling" for both home and foreign orders. It should also be realized that war orders have increased the capacity and diversity of output of our competitors, making former competition none the less, but rather a great deal more. The need of organizing is therefore particularly and peculiarly urgent.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey forge, Pittsburgh	$17 95	
Lake Superior, charcoal, Chicago	17 75	
Ferro nickel pig iron (Soo)	25 00	
	Montreal.	**Toronto.**
Middlesboro, No. 3	$24 00	.....
Carron, special	25 00	.....
Carron, soft	25 00	.....
Cleveland, No. 3	24 00	.....
Clarence, No. 3	24 50	.....
Glengarnock	28 00	.....
Summerlee, No. 1	30 00	.....
Summerlee, No. 3	29 00	.....
Michigan charcoal iron.	28 00	.....
Victoria, No. 1	24 00	24 00
Victoria, No. 2X	23 00	24 00
Victoria, No. 2 plain ..	23 00	24 00
Hamilton, No. 1	23 00	24 00
Hamilton, No. 2	23 00	24 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto..	2.50
Steel bars, f.o.b., Toronto........	2.75
Common bar iron, f.o.b., Montreal	2.50
Steel bars, f.o.b., Montreal	2.75
Twisted reinforcing bars	2.55
Bessemer rails, heavy, at mill....	1.25
Steel bars, Pittsburgh	...
Tank plates, Pittsburgh	...
Beams and angles, Pittsburgh....	...
Steel hoops, Pittsburgh	
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.75
Small shapes	2.75
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	2.20
Structural shapes	2.30
Plates	2.30

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal	Toronto
Plates, ¼ to ½ in., 100 lb.	$2 75	$2 75
Heads, per 709 lb.	3 00	3 00
Tank plates, 3-16 in.	3 00	3 00

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$13 75	13 50
Copper, crucible	16 25	16 00
Copper, unch-bled, heavy	15 75	15 00
Copper, wire, unch-bled..	15 75	15 25
No. 1 machine compos'n	12 00	11 75
No. 1 compos'n turnings	11 00	10 00
No. 1 wrought iron	10 00	10 00
Heavy melting steel	9 50	9 50
No. 1 machin'y cast iron	13 50	13 00
New brass clippings	11 50	11 00
No. 1 brass turnings ...	9 50	9 00
Aluminum	29 00	29 00
Heavy lead	5 25	5 00

Tea lead ....$	4 25	$ 4 25
Scrap zinc	12 75	12 00

W. I. PIPE DISCOUNTS.

Following are Toronto jobbers' discounts on pipe in effect Nov. 5, 1915:

	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
Standard				
¼, ⅜ in.	62	38½	....	....
½ in.	67	47½	....	....
¾ to 1½ in. ..	72	52¼	....	....
2 in.	72	52½	68	48½
2½ to 4 in. ...	72	52½	71	51½
4½, 5, 6 in...	....	....	69	49½
7, 8, 10 in. ...	....	....	66	44½
X Strong P. E.				
¼, ⅜ in	55	38½	....	....
½ in	62	45½	....	....
¾ to 1½ in. ..	66	49½	....	....
2, 2½, 3 in. ..	67	50½	....	....
2 in.	....	....	62	45½
2½ to 4 in ..	....	....	65	48½
4½, 5, 6 in. ..	....	....	65	48½
7, 8 in	....	....	58	39½
XX Strong P. E.				
½ to 2 in	43	26½	....	....
2½ to 6 in. ...	....	....	42	25½
7 to 8 in.	....	....	39	20½
Genuine Wrot Iron.				
⅜ in	56	32½	....	....
½ in	61	41½	....	....
¾ to 1½ in. ..	66	46½	....	....
2 in.	66	46½	62	42½
2½, 3 in.	66	46½	65	45½
3½, 4 in.	....	....	65	45½
4½, 5, 6 in. ..	....	....	62	42½
7, 8 in.	....	....	59	37½

Wrought Nipples.	
4 in. and under	77½%
4½ in. and larger	72%
4 in. and under, running thread.	57½%
Standard Couplings.	
4 in. and under	60%
4½ in. and larger	40%

MILLED PRODUCTS.

Sq. & Hex Head Cap Screws	65 & 5%
Sq. Head Set Screws	70 & 5%
Rd. & Fil. Head Cap Screws.....	45%
Flat & But. Head Cap Screws....	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in.	70%
Semi-Fin. Nuts up to 1 in.	70%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

METALS.

	Montreal.	Toronto.
Lake Copper, carload ...	$21 50	$20 75
Electrolytic copper	21 25	20 [illegible]
Castings, copper	21 00	20 50
Tin	45 00	43 00
Spelter	21 00	18 00
Lead	6 75	7 00
Antimony	42 00	40 00
Aluminum	70 00	65 00

Prices per 100 lbs.

BILLETS.

	Per Gross Ton
Bessemer billets, Pittsburgh....	$30 00
Open-hearth billets, Pittsburgh..	31 00
Forging billets, Pittsburgh	52 00
Wire rods, Pittsburgh	40 00

NAILS AND SPIKES.

Standard steel wire nails, base	$2 80	$2 85
Cut nails	2 90	2 90
Miscellaneous wire nails..	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	3 25	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	60 and 5
Stove bolts	82½
Plate washers	40
Machine bolts, ⅜ and less	65
Machine bolts, 7-16 and over	50
Blank bolts	50-7½
Bolt ends	50-7½
Machine screws, iron, brass.....	35
Nuts, square, all sizes	3¾c per lb off
Nuts, hexagon, all sizes...	4¼c per lb. off
Iron rivets	67½
Boiler rivets, base, ¾-in. and larger	$3.75
Structural rivets, as above	3.75
Wood screws, flathead, bright	85, 10, 10 p.c. off
Wood screws, flathead, brass	67½ p.c. off
Wood screws, flathead, bronze	60 p.c. off

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Standard. Price. per ft.	Extra Strong, Sizes Ins.	Extra Strong, Price per ft.	D. Ex. Strong, Size Ins.	D. Ex. Strong, Price per ft.
⅛in	$.05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	....
7 in	2.38	7 in	3.81	....	....
8 in	2.50	8 in	4.34	....	....
8 in	2.88	9 in	4.90	....	....
9 in	3.45	10 in	5.48	....	....
10 in.	3.20	....	....	....	....
10 in.	3.50	....	....	....	....
10 in.	4.12	....	....	....	....

COKE AND COAL

Solvay Foundry Coke	$6.25
Connellsville Foundry Coke	5.65
Yough Steam Lump Coal	3.63
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

COLD DRAWN STEEL SHAFTING.

At mill	25%
At warehouse	20%

Discounts off new list. Warehouse price at Montreal and Toronto.

MISCELLANEOUS

Solder, half-and-half	0.23½
Putty, 100-lb. drums	2.70
Red dry lead, 100-lb. kegs, per cwt.	9.65
Glue, French medal, per lb.	0.15
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.25½
Benzine, single bbls., per gal.	0.25
Pure turpentine, single bbls.	0.87
Linseed oil, raw, single bbls.	0.87
Linseed oil, boiled, single bbls.	0.90
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.50
Lead Wool, per lb.	0.11
Pure Manila rope	0.16
Transmission rope, Manila	0.20
Drilling cables, Manila	0.17
Lard oil, per gal	0.73
Union thread cutting oil	0.60
Imperial quenching oil	0.35

POLISHING DRILL ROD

Discount off list, Montreal and Toronto 40%

PROOF COIL CHAIN.

¼ in.	$9.00
5-16 in.	5.90
⅜ in.	4.95
7-16 in.	4.55
½ in.	4.00
9-16 in.	4.20
⅝ in.	4.10
¾ in.	3.95
⅞ in.	3.80
1 inch	3.70

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	55
Carbon over 1½ in.	25
High Speed	
Blacksmith	55
Bit Stock	60 and 5
Centre drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Centre	25
Pipe Reamers	80

Discounts off standard list.

IRON PIPE FITTINGS.

Canadian malleable, A, 25 per cent.; B and C, 35 per cent.; cast iron, 60; standard bushings, 60 per cent.; headers, 60; flanged unions, 60; malleable bushings, 60; nipples, 75; malleable, lipped unions, 65.

TAPES

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3.50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$3 50	$3 50
Canada plates, dull, 52 sheets	3 25	3 25
Canada Plates, all bright	4 60	4 75
Apollo brand, 10¾ oz. galvanized	5 50	5 50
Queen's Head, 28 B.W.G.	6 00	6 00
Fleur-de-Lis, 28 B. W. G.	5 75	5 75
Gorbal's Best, No. 28	6 10	6 10
Viking metal, No. 28	5 25	5 25
Colborne Crown, No. 28	5 70	5 80
Premier No. 28	5 40	5 50
Premier, 10¾ oz.	....	5 75

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$14 25	....
1¼ in.	15 00	....
1½ in.	15 00	....
1¾ in.	15 00	....
2 in.	15 00	10 00
2¼ in.	16 50	11 00
2½ in.	17 50	12 85
3 in.	25 00	13 20
3½ in.	28 00	16 25
4 in.	33 00	20 75

Prices per 100 feet, Montreal and Toronto.

WASTE.

WHITE.	Cents per lb.
XXX Extra	0 11½
X Grand	0 11
XLCR	0 10¼
X Empire	0 09½
X Press	0 08¾
COLORED.	
Lion	0 07¾
Standard	0 07
Popular	0 06¼
Keen	0 05½
WOOL PACKING.	
Arrow	0 17
Axle	0 12
Anvil	0 09
Anchor	0 07
WASHED WIPERS.	
Select White	0 08½
Mixed Colored	0 06¼
Dark Colored	0 05¼

This list subject to trade discount for quantity.

BELTING RUBBER

Standard	50%
Best grades	30%

BELTING—NO. 1 OAK TANNED.

Extra heavy, single and d'ble, 40 & 10%	
Standard	50%
Cut leather lacing, No. 1	$1.20
Leather in sides	1.10

ELECTRIC WELD COIL CHAIN B B.

⅛ in.	$12.75
3-16 in.	8.85
¼ in.	6.15
5-16 in.	4.90
⅜ in.	4.05
7-16 in.	3.85
½ in.	3.75
⅝ in.	3.60
¾ in.	3.60

Prices per 100 lbs.

PLATING CHEMICALS

Acid, boracic	$ .15
Acid, hydrochloric	.05
Acid, hydrofluoric	.06
Acid, nitric	.10
Acid, sulphuric	.05
Ammonia, aqua	.08
Ammonium carbonate	.15
Ammonium chloride	.11
Ammonium hydrosulphuret	.35
Ammonium sulphate	.07
Arsenic, white	.10
Copper sulphate	.10
Cobalt sulphate	.50
Iron perchloride	.20
Lead acetate	.16
Nickel ammonium sulphate	.10
Nickel carbonate	.50
Nickel sulphate	.15
Potassium carbonate	.40
Potassium sulphide (substitute)	.20
Silver chloride (per oz.)	.65
Silver nitrate (per oz.)	.45
Sodium bisulphite	.10
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.35
Sodium hydrate	.04
Sodium hyposulphite (per 100 lbs.)	3.00
Sodium phosphate	.14
Tin chloride	.45
Zinc chloride	.20
Zinc sulphate	.07

Prices Per Lb. Unless Otherwise Stated.

ANODES

Nickel	.47 to .52
Cobalt	1.75 to 2.00
Copper	.22 to .25
Tin	.45 to .50
Silver	.55 to .60
Zinc	.22 to .25

Prices Per Lb.

PLATING SUPPLIES

Polishing wheels, felt	1.50 to 1.75
Polishing wheels, bullneck.	.80
Emery in kegs	.4½ to .06
Pumice, ground	.05
Emery glue	.15 to .20
Tripoli composition	.04 to .06
Crocus composition	.04 to .06
Emery composition	.05 to .07
Rouge, silver	.25 to .50
Rouge, nickel and brass	.15 to .25

Prices Per Lb.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents

Montreal, Que., Dec. 13, 1915.—Reports from all sources continue to show that satisfactory conditions prevail throughout the steel, iron and metal industries, and while munitions are the chief feature of the activity, many other lines are in more or less good demand.

Pig Iron

Local conditions in the pig iron market are little changed from the previous week. Production continues at maximum capacity to supply the demands made upon the steel makers. In spite of the high prices, considerable inquiries are coming in from foundries. The question of transportation of both ore and iron is having a tendency to advance prices on some grades. A disturbing factor for the coming year is the possibility of a shortage in vessel tonnage for the shipment of ore.

Steels

The tension in the steel situation shows little indication of relaxation; in fact, the pressure upon producers seems to be increasing, and the period of future deliveries is constantly being extended. While bars and billets are principally in demand, the inquiries for bars, plates, etc., continue to increase.

Many mills are limiting orders to a proportion of customers' requirements, and in some instances inquiries are not even considered. Producers of steel have business booked for many months ahead, and in a great number of cases orders for second and third quarters of 1916 cannot be taken on.

The continued scarcity of tungsten keeps the figures for high-speed steel excessively high, and little relief is immediately expected. However, by the spring of next year, the situation may be somewhat relieved. Present quotations are $2.50 to $3.25 per pound.

Metals

The general condition of the metal market is dull, with prices firm. Local spelter shows a slight advance, while aluminum records another jump of 5c per pound. Present conditions will likely prevail until the close of the year.

Copper.—The lively condition of the copper market for the past few weeks has now ceased, and indications are that little change will be noted for the remainder of the month. Slight declines are quoted in the United States markets, but local prices are holding firm.

Tin.—No new developments have taken place during the past week, and the general dullness continues, with the possibility of a further slight decline before the opening of the New Year. A considerable supply of tin is in sight, and this has weakened the foreign markets. However, the local dealers are quoting last week's figures of 45 cents per lb.

Spelter.—Conflicting reports are being circulated regarding the spelter situation, and it would seem that speculators are trying to force prices up. It is generally conceded that recent advances are due to this, more so than supply and demand. However, the quiet condition at present tends to retain firmness, and, while foreign prices have declined somewhat, local dealers have advanced their quotations 1c per pound, which leaves the present price at 21c.

Lead.—The outlook from present conditions are that the market will show weakness in a short time, a decline being generally expected. Last week's quotation of 6¾c holds firm for the present.

CANADIAN GOVERNMENT PURCHASING COMMISSION

The following gentlemen constitute the Commission appointed to make all purchases under the Dominion $100,000,000 war appropriation:—George F. Galt, Winnipeg; Hormidas Laporte, Montreal; A. E. Kemp, Toronto. Thomas Hilliard is secretary, and the commission headquarters are at Ottawa.

Antimony.—The market is steady and prices are firm at 42 cents per lb.

Aluminum.—The demand for aluminum continues to boost the price, and inquiries are numerous. Local dealers have advanced their quotations from 65 cents to 70 cents per pound.

Old Material.—Local scrap conditions remain unchanged, with a fair amount of transactions passing. Heavy melting steel scrap is quite active, and the demand is increasing. Present prices show an advance of $10 per ton over last week. The shortage of aluminum has advanced the price of its scrap to 27 cents per pound.

Toronto, Ont., Dec. 14.—There is little change to note in the general situation. The revival in trade continues and the outlook is distinctly favorable. The export trade is increasing in volume while domestic trade has improved considerably of late. Railways report substantial increases in earnings, and bank clearings exceed last year as also those of the previous year, which are favorable indications as to the increase in the volume of trade, and improvement in conditions generally. The shortage of tonnage and high ocean freight rates are a serious inconvenience to importers and exporters, and have not only increased the cost of certain products but have affected deliveries also.

The steel market continues very strong with every possibility of higher prices. The demand for steel for shells is increasing and is greater than the Canadian mills can produce. Preparations are being made for turning out the large-calibre shells which will call for a considerable increase in tonnage. The machine tool trade is active and dealers report very satisfactory business. In the metal market, tin and spelter have declined, otherwise prices are unchanged. The market generally is quiet.

Steel Market

The extraordinary activity in the steel trade continues and there is no sign of any recession. The steel companies have more business than they can handle and are booked up for months ahead. The demand is so much greater than the Canadian mills can supply that concerns working on shell contracts are obliged to buy raw materials from the States. It is stated that several large contracts for steel forgings and round steel bars which have been under negotiation between Canadian concerns and American mills are held in abeyance temporarily. It is understood, however, that the contracts will eventually be placed in the States. Under prevailing conditions, prices of steel are bound to advance, the market being very strong. Boiler plates have advanced again, and higher prices for domestic steel and iron bars are expected any time. There is no change in the situation with regard to American bars, shapes, etc., and prices are still withdrawn.

The galvanized sheet market is very irregular. Many makers have discontinued quoting on sheets on account of the fluctuations in the spelter market. Prices of black sheets continue to advance and all other materials used in the manufacture of galvanized sheets are also higher. Prices of galvanized sheets are very fair, and are expected to go higher.

Prices continue to advance in the States and the export demand is increasing. The French government is enquiring for thousands of tons of round steel bars. Many of the mills are increasing their capacity, but are as far behind as ever on delivery. Steel bars are quoted at 1.70c base, and iron bars 1.80c base, Pittsburgh. Billets continue to advance

on heavy demand. Bessemer billets are now quoted at $30 and open-hearth billets at $31 Pittsburgh. Forging billets are unchanged at $52, and wire rods are higher at $40 Pittsburgh.

Pig Iron

The pig iron market is very strong and prices continue to advance. A large percentage of the tonnage is going into steel, there being little demand for foundry grads. "Hamilton" and "Victoria" brands have advanced $1, and are now quoted locally at $24 per ton. The market for pig iron in the States is becoming excited and prices are advancing. "Grey Forge" is now quoted at $17.95 Pittsburgh. It is understood that quotations on "Lake Superior" iron ore for the coming season have been made. "Mesaba Bessemer" is quoted at $4.25, which is 80c above this year's basis. On "Mesaba non-Bessemer," 70c advance over this year is asked.

Old Materials

There is little change to note with regard to the situation in old materials. The market generally is firm with higher prices for heavy melting steel, aluminum and lead, while the various grades of copper have also advanced slightly. The market is not very active but there is a fair demand for copper and heavy melting steel. There is a continued scarcity of aluminum; this has strengthened the market for scrap metal.

Machine Tools

The market is very active and there is a good demand for machinery for shells, principally for the larger sizes. Some orders for 8-in. shells have been placed, and the concerns thus favored are getting their plants in shape for machining them. There appears to be a possibility of the situation as regards getting machine tools, being considerably relieved. There is a growing belief in the American market that purchases of machine tools for shipment to England will in the future be of comparatively small proportions. It is believed that munition making plants of Great Britain are now capable of meeting all requirements; the demand for tools is, therefore, less urgent. In this event, machine tools will be easier to obtain for this market and deliveries will be better. It is understood that Russia is buying a large amount of equipment, not only lathes, but practically a general line of tools.

Supplies

A few price changes have to be noted this week. Solder is down ½c. due to the continued weakness in the tin market. Linseed oil market is very strong and prices have advanced 2c, the new quotation being 87c for raw and 90c for boiled, per gallon. Turpentine is 2c higher and is now quoted at 87c per gallon High-speed twist drills keep on advancing and the situation is such that it is impossible to give a firm quotation. Business continues very good, there being an active demand for supplies from shell plants.

Metals

The market is quiet this week and lower levels for tin and spelter have again to be noted, other metals being unchanged. Copper is quiet, although the market is in a strong position. The lead market is quiet but firm. There is no change in the antimony situation, and the aluminum market is featureless. There is a continued active demand for metals for munitions, but ordinarily business is quiet.

Tin.—Although the primary markets are firm, tin is weaker locally and has declined 2c. There is a fair demand, but stocks are accumulating, which may depress the market. Tin is quoted locally at 43c per pound.

Copper.—The market is in a strong position, although quiet and unchanged. There is apparently a lull in demand, both for domestic and export. "Lake Copper" is quoted at 20¾c per pound.

Spelter.—The market is in a very peculiar condition, and it is difficult to size up the situation. There is good inquiry but sellers are not showing much disposition to do business. Spelter has declined 2c locally and quotations are more or less nominal at 18c per pound. Zinc ore is quoted from $80 to $105, Joplin, Mo.

Lead.—The market is quiet but firm at the "Trust" equivalent of 5.25c New York. The ore is quoted at $70 to $73, Joplin, Mo. Lead is unchanged locally at 7c per pound.

Antimony.—Conditions in the antimony market are unchanged. Spot stocks are scarce but futures are being freely offered at a concession of about 2c less than the spot market. Local quotations are unchanged at 40c per pound.

Aluminum.—There is no change in the situation. Supplies are scarce and the demand continues heavy. Quotations are nominal at 65c per pound.

ALLIES PURCHASING AGENTS

The Trade and Commerce Department, Ottawa, has published the following list of purchasing agents for military purposes for the allied Governments:

International Purchasing Commission, India House, Kingsway, London, Eng.

French.—Hudson Bay Co., 56 McGill Street, Montreal; Captain Lafoulloux, Hotel Brevort, New York; Direction de l'Intendence Ministere de la Guerre, Bordeaux, France; M. De la Chaume, 28 Broadway, Westminster, London.

Russian.—Messrs. S. Ruperti and Alexsieff, care Military Attache, Russian Embassy, Washington, D.C.

CANADIAN EXPORTS TO GREAT BRITAIN

AN increase in imports from Canada of $34,697,000 and a decrease in exports to Canada of $20,498,000 during the first nine months of the present fiscal year is shown by figures for that period received by the Trade and Commerce Department from Commissioner Ray, of Birmingham. The total imports from Canada were $138,917,000, and exports to the Dominion $49,407,000.

Details are also furnished of the recent steps taken by the British authorities in respect to the requisitioning of all ships of British register, which regulations closely affect Canada. These show that rumors that the Government contemplates the requisitioning of the entire British mercantile marine are without foundation, but that power has been taken to deal, by the requisitioning of a sufficient number of vessels, with cases where an emergency of national importance exists at any particular market owing to the absence of tonnage, and, further, to regulate the employment of British shipping in the carriage of cargoes between foreign parts by means of licenses.

COMPENSATION ACT ADJUSTMENTS

A NUMBER of important changes in the grouping of industries under the Workmen's Compensation Act have been decided upon by the Workmen's Compensation Commission. The chief changes are a regrouping of the iron industries, in response to a request from employers; the separation of the manufacture of explosives from all other industries, and the uniting of all the building trades in one class. There has also been a rearrangement of railway, canal, roadmaking and bridgebuilding industries.

Theatres and moving picture houses, and the operation of elevators not in industries under Schedule 1, which had formerly been specifically included, are now excluded. The Board has also made the Act apply expressly to a number of industries hitherto considered to be covered by the general scope of the Act, but not expressly mentioned. The exclusion of machine shops, cabinet shops, and tinsmith shops with less than a specified number of employees has also been removed, and exclusion from the schedule

is permitted in regard to certain wood operations carried on for the most part by farmers and settlers, and to repairing or small building operations carried on by owners of rented houses or buildings. The changes come into effect on January 1, and will not affect employers during the present year.

The Board announces that employers must send in their next pay roll statement by the 20th of January. In the meantime a circular explaining the changes in detail will be prepared for distribution, together with the pay roll form for the coming year.

DOMINION COAL CO. ST. LAWRENCE SEASON

THE quantity of coal transported to St. Lawrence ports by the Dominion Coal Co. during the 1915 season of navigation was about 1,600,000 gross tons. In addition to this, something over 100,000 tons will have to be handled through Portland over the ensuing winter months, making a total for St. Lawrence ports of 1,700,000 tons.

A slightly larger quantity was transported to Montreal during the 1914 season, but the difference is accounted for by the fact that steamers formerly taking large bunker supplies to St. Lawrence ports were diverted to Sydney in the season just past, and bunkered either on their inward or outward voyage.

Steamers employed in the coal-carrying trade made 310 trips to St. Lawrence ports during the season of navigation just ended, and vessels from the Upper Lakes, as well as the seven seas, were secured in order to carry this large amount of coal at a time notable for shortage of tonnage.

POWER DEVELOPMENT AT MUSKOKA

THE Hydro-Electric Power Commission of Ontario has under way the extension of a power plant on the south branch of the Muskoka River. This plant, located at South Falls, and formerly operated to supply the town of Gravenhurst, has a single unit with a capacity of 450 k.w. It is being enlarged by the addition of a 750 k.v.a. unit. Excavation work was recently commenced and most of the equipment has been ordered.

Provision was made in the design of the existing plant for such an extension, and the installation of the latter does not alter the previous arrangement.

A wood stave pipe line, 100 feet long, will connect the existing headworks with about 60 feet of steel penstock leading to the new unit. The headgate mechanism, steel penstock, turbine, governor and relief valves are all being supplied by the William Hamilton Co., of Peterborough, Ont., the generator and the transformers by the Canadian General Electric Co., Ltd., Peterborough, and the wood pipe line by the Pacific Coast Wood Stave Pipe Co. The latter is being laid by the commission. Orders for the switchboard equipment have not yet been placed.

The extended plant will supply the towns of Gravenhurst, Bracebridge and Huntsville.

NEW ELECTRIC STEEL FURNACE PLANT

THE Canadian Electro-Products Co., whose incorporation with a capital of $500,000 was announced recently, expects to have a new electric furnace plant for the manufacture of high-grade steel in operation in Montreal in about a month or six weeks. The plant is being designed on the basis of two units, each of a capacity of 25 tons of steel a day, and at least one of these units should be in operation within the time mentioned.

The authorized capital of $500,000, it is understood, will be half in preferred and half in common shares, but only a portion of the authorized amount will be necessary for the initial installation. Probably $100,000 will be required to equip the plant to start with, and this is being subscribed privately.

J. S. Norris, of the Montreal Light, Heat & Power Co. and Messrs. Howard Murray and Julian C. Smith, of the Shawinigan Water and Power Co., are among those behind the new venture and will be members of the board of directors when organization is completed. The company, however, is a private enterprise, and will not be a subsidiary of either Montreal Power or Shawinigan Power. However, as the operation of the new plant, when both units are working, will call for about 4,000 h.p., naturally both the older companies will benefit, one as the distributor and the other as the producer of the power required.

The new venture represents a further extension of the electric furnace idea, which is playing so large a part in the increased consumption of power in this province. It has been applied to the aluminum and carbide industries in the Shawinigan district on a large scale. As applied to steel on the lines proposed, it is a new proposition here, but similar plants are in operation at Welland and Sherbrooke.

CANADIAN PURCHASES FOR FRENCH WAR OFFICE

Philippe Roy, General Commissioner for Canada, Paris, advises the Department of Trade and Commerce, Ottawa, that an order has been issued by the War Department of the French Government to the effect that all purchases made by the Supply Branch in Canada will pass through the Hudson Bay Co. Canadian producers should therefore submit their future offers through the office of that company at Montreal. It is further stated in Mr. Roy's communication that Canadian lumber, steel and meat will find in France an important market for years to come, but it is necessary that Canadian firms should have in Paris representatives entrusted with the necessary authority, especially if it is desired to secure Government contracts.

DOMINION TRADE RETURNS

AN expanding revenue and a decreased expenditure on consolidated account are shown in the November financial statement of the Dominion issued on Dec. 10. The total revenue to the end of November was $104,756,305.25, as against $90,468,002.68 for the corresponding period of last year, increases appearing under all heads, with the exception of excise. The consolidated fund expenditure dropped from $75,708,627 to $65,345,503.

Expenditure on capital account outside of the war outlay also shows a substantial reduction. The 1914 column shows no war expenditure, but the outlay last month under this head is given as $13,155,797, bringing the capital expenditure on war for the fiscal period up to $66,514,955. The total capital expenditure to the end of November was $91,475,889, as against $28,231,933 for the same period last year. The gross debt increased by $202,225,076, and stood at $829,377,292 at the close of the month. The funded debt payable in Canada rose from $774,060 in November, 1914, to $8,725,450 in November, 1915. The funded debt payable in England increased from $329,020,000 to $342,703,302. Temporary loans rose from $20,573,333 to $165,007,017.

Increases in the sinking funds and miscellaneous and banking accounts brought the total assets of the Dominion up to $327,709,125, as against $262,308,968, the total net debt thus standing at $501,668,167, as compared with $364,843,247. The monthly increase in the net debt was $9,139,675, as against $12,167,848, a decrease of $3,028,175.

Stratford, Ont.—The directors of the People's Telephone Co. have decided to purchase the Forest plant of the Bell Telephone Co. It is expected that the change will be made at the commencement of the New Year.

ONTARIO MINERAL OUTPUT

RETURNS made to the Ontario Bureau of Mines for the nine months, ending September 30, 1915, show an increase in value of gold of $1,884,093, and a decrease in value of silves of $2,051,760. It is pointed out that the increase in the production of gold amounts to one-third.

The gold districts of Northern Ontario, the report says, are fulfilling the prediction made several years ago that they would make good the loss caused by the waning of the silver mines of Cobalt. Thus, the combined value of the gold and silver output of the first nine months of the present year was only $167,661 less than for the same portion of 1914, notwithstanding the fact that the yield of silver fell off over 20 per cent. Part of this decrease is due to the low prices which prevailed during the whole nine months, but which made a sharp recovery in November.

The Sudbury mines are being worked to the maximum capacity, and the production of nickel for the nine months nearly equals the largest previous output for a full year. Over 75 per cent. of the output is made by the Canadian Copper Co., but the operations of the Mond Co. are now more extensive than formerly, and its output has correspondingly increased.

The yield of copper was also much greater than in the corresponding period of 1914 and nearly equalled the total output of that year.

New Incorporations

The Montreal Steel & Foundry Co. has been incorporated at Ottawa, with a capital of $150,000, to manufacture all kinds of machinery and mechanical specialties, appliances and instruments, at Montreal, Que. Incorporators: Emilien Gadbois, Joseph Marechal Nantel, and Charles G. Derome, all of Montreal, Que.

The Barrymore Cloth Co. has been incorporated at Toronto, with a capital of $250,000, to take over as a going concern the cloth manufacturing portion of the business of the Toronto Manufacturing Co., of Toronto, Ont. Incorporators: Edmund Percival Brown and Wm John McWhinney, of Toronto.

The Wood Products Co. has been incorporated at Toronto, with a capital of $100,000, to engage in the destructive distillation of wood and to manufacture charcoal, wood alcohol and all other products. Head office at Toronto. Incorporators: Arthur Wellesley Holmestead and James Leith Ross, of Toronto.

The International Steel Corporation, Ltd., has been incorporated at Ottawa, with a capital of $100,000, to manufacture, produce and deal in iron, steel and all other metals, at Toronto. Incorporators: James Richardson Roaf, Wm. Graham and John E. Mordon, all of Toronto, Ont.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Glace Bay, N.S.—The town council propose installing a pumping plant.

Hamilton, Ont.—The Monarch Machine Tool Co. will start work shortly on a war order.

Hamilton, Ont.—The Steel Co. of Canada, Ltd., will make considerable extensions to their plant.

Georgetown, Ont.—The Glass Garden Builders, Ltd., will erect a factory to cost about $25,000.

Montreal, Que.—The Williams Mfg. Co. will build a foundry at their plant on St. James street.

Hamilton, Ont.—The Dominion Steel Castings Co. will build an extension to their plant.

Bedford, Que.—A pumping plant will be installed in connection with the waterworks extensions now in progress.

Toronto, Ont.—The Board of Control will call for tenders for the supply and installation of a boiler at the municipal abattoir.

London, Ont.—The Battle Creek Toasted Corn Flake Co., Ont., will install electrical equipment to operate its machinery.

Halifax, N.S.—Work has been started on the erection of a steel plant for the Williston Steel & Foundry Co. Approximate cost, $16,000.

New Glasgow, N.S.—The Nova Scotia Steel & Coal Co. are building an addition to their steel plant at Sidney Mines, estimated to cost $100,000.

Fort Frances, Ont.—Russel Bros., machinists, have secured a contract for shells and will remove to Port Arthur where a plant will be equipped with the necessary machinery.

Edmonton, Alta.—G. W. Farrell & Co., of Montreal, Que., has signed a contract to supply power to the city. It will build a power plant and an electric railway to cost $6,000,000.

Arnprior, Ont.—The Galetta Power Co. are considering developing a water power at Long Rapids on the Madawaska river. A minimum of 13,000 h.p. could be developed at that point, but it would be difficult at present to dispose of so much power.

Quebec, Que. Fire damaged the Eastern Canada Steel Co. plant, St. Malo, recently. The cause of the fire is not exactly known, but it is supposed that it originated through an explosion in the furnace room. The damage, which is said to be around $100,000, is covered by insurance.

Grimsby, Ont.—T. D. G. Bell and his associates have formed a new company to be known as Bells, Limited, for the purpose of making war munitions. The new company has rented the necessary space and plant from the Bell Fruit Farms, Ltd., and the new machinery to make munitions will be installed in a portion of the factory.

Montreal, Que.—The manufacture of steel billets will shortly be begun by Montreal. Power-Shawinigan. interests, who have purchased the Record Foundry Building, and are now installing the necessary equipment. The concern, known as the Canadian Electro-Products Co., has secured its charter and machinery, including an electric furnace.

Stratford, Ont.—At a meeting of the Finance Committee of the City Council on Dec. 5, a committee composed of Chairman Ald. Henry and Aldermen Forbes, Mantle and Pauli, was appointed to sell the machinery which is being cleaned out of the basement in the Kemp factory, to make room for the recruits to the 110th Batt.

Municipal

Collingwood, Ont.—The proposed by-law in connection with Wilson Bros. has been withdrawn.

Toronto, Ont.—The Board of Control has decided to submit the hydro-radial to the ratepayers on Jan. 1.

Windsor, Ont.—A by-law is being prepared to sanction the expropriation of the Windsor Gas Co.

Islington, Ont.—Etobicoke Township ratepayers will vote New Year's Day on the proposed system of Hydro-radials.

Petrolia, Ont.—A by-law in connection with the proposed sugar refinery will be submitted to the ratepayers on Jan. 3.

Berlin, Ont.—The city council have decided to submit the hydro-radial bylaw to the electors at the January elections.

Chatham, Ont.—A by-law will be voted on by the ratepayers to sanction an expenditure of $10,000 on fire-fighting apparatus.

Chatham, Ont.—A by-law will be submitted to the ratepayers relative to granting concessions to the Dominion Sugar Co.

Baden, Ont.—The township council have decided to submit the hydro-radial by-law to the ratepayers of Wilmot Township on Jan. 3.

Chatham, Ont.—A by-law will be submitted to the ratepayers at the January elections regarding concessions to the Gray-Dart Automobile Co.

Sarnia, Ont.—A by-law will be voted on by the ratepayers on Jan. 3 to raise $120,000 for the purchase of the Sarnia Gas and Electric Light Co. plant.

Sarnia, Ont.—A by-law will be submitted to the ratepayers on Dec. 29 to authorize raising $12,000 to pay for waterworks extensions.

Tara, Ont.—A by-law will be submitted to the ratepayers on Jan. 3 to authorize an expenditure of $7,500 on a hydro-electric distribution plant.

Sherbrooke, Que.—The City Council contemplates alterations and improvements to the water power, electric transmission and lighting plants.

Listowel, Ont.—A by-law will be voted on by the ratepayers on Jan. 3, to authorize a loan of $12,000 to a company who propose to establish a boot factory here.

Cobden, Ont.—The town council will submit a by-law on December 27 to provide for the construction of a plant for the generation and distribution of power. Estimated cost, $20,000.

Princeville, Que.—The town council contemplates the erection of a pump station and the purchase of a 4-inch and 6-inch cast iron pipe, valves, pumps and hydrants.

Swift Current, Sask.—The City Council will engage an engineer to make a thorough examination of the pumping and waterworks system and advise as to what will be required to make the system thoroughly efficient.

Lindsay, Ont.—A by-law will be voted on at the January elections to authorize the granting of a loan of $15,000 to a

Large Shells : Production Problems and Possibilities--VI.

By C. T. D.

In preparing to undertake the production of large shells up to 9.2 in. dia., manufacturers will encounter problems of a nature altogether different from those connected with 18 pdr. shells. Automatic machinery will not be so applicable to the larger sizes, and productive ability will centre largely on such points as sequence of operations, tooling methods, etc.

An example of a special purpose machine is shown in illustration Fig. 18. This is a recently developed machine for performing the major operations on large shells, although its scope in finishing the minor operations such as recessing, grooving, tapping, etc., is limited by the ingenuity of the tooling outfit, and the commercial aspect of the operations performed.

This machine is known as the "Hart-Parr" lathe, swinging 26 in. over the vees, and capable of handling 9.2 in. shells rapidly and efficiently.

As can be seen in the illustration the machine is of massive design, the whole being characterized by simplicity of construction and directness of operation. Headstock and bed are cast integral, the former being of plain and rigid box type construction. The spindle is of exceedingly generous proportions, and is mounted in annular ball bearings of ample capacity.

The spindle drive is from a transverse shaft, one end of which projects in front of the headstock carrying a large diameter 4-step cone pulley, while the other end extends to the back of the headstock where a compact double gearing arrangement is mounted which transmits the power to a worm meshing with a large worm wheel fastened to the spindle.

The feed gear to the work carriage is of the simplest possible description. A pair of six-step cone pulleys are mounted on the tail end of the spindle, and a short intermediate feed shaft on the front of the bed. This intermediate shaft drives the main feed shaft through three pairs of gears, giving two working speeds and one quick return, which can be operated selectively in either direction.

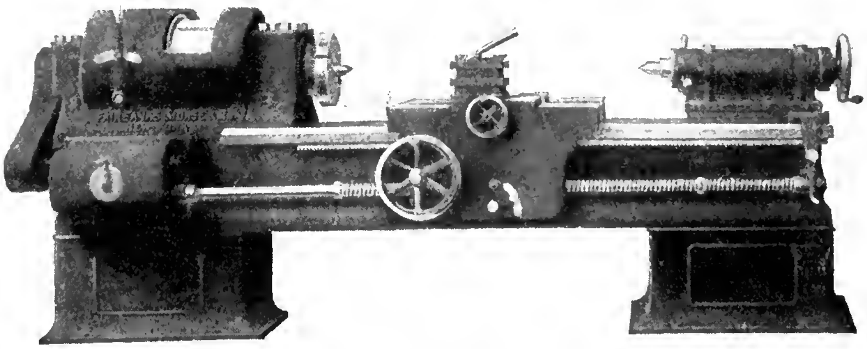


FIG. 19. HEAVY DUTY 26-IN. DOUBLE BACK-GEARED MANUFACTURING LATHE FOR SHELLS UP TO 12 IN. DIA.

The carriage is of the simplest possible description, hand and power traverse, and hand operated cross slide, carrying a four-sided tool box of the ordinary type.

When machining shell forgings, the open end of the shell is first cut off in any suitable machine with a reasonable degree of accuracy. The shell is then mounted directly upon the carriage on suitable supports, and secured by heavy clamps. The first tool head inserted in the ends of the spindle carries a single point tool which takes a roughing cut off the parallel portion of the bore, making it truly round.

By means of a special arrangement of drift, the first head is quickly removed, and another tool head, carrying a rough sizing reamer and a rough arch forming tool, is inserted. The cut thus obtained finishes the parallel portion of the bore to a fixed size, and rough forms the arch of the nose.

The next change of cutter heads brings into operation a finishing reamer which completes the forming of the interior arch. Three boring cuts thus complete the interior with the exception of recessing and facing which can be performed at the same time if proper tooling arrangements are provided. Should the forgings be exceedingly rough or out of truth, it may be found necessary to take one or two additional cuts.

The shell is now removed from the machine and mounted upon another of the same type, which is provided with an exceptionally stiff expanding arbor, thus truing up the work from the interior. A profiling cam is mounted on the back of the lathe in the now familiar manner which enables the entire trimming of the outside of the shell to be completed.

If suitable extra attachments are provided, it is possible to machine the groove and form the waved threads for the driving band, as well as boring tapping and threading the fuse opening in the nose. It is quite probable, however that these lighter operations can be accomplished to better advantage on lathes of ordinary types, leaving the entire productive ability of this machine to be concentrated on that work which it is cap-

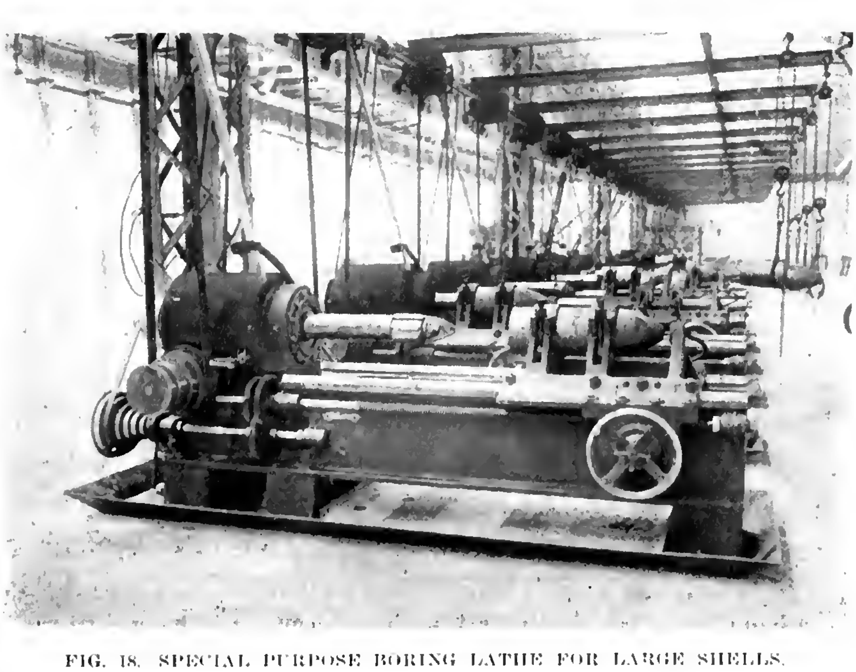


FIG. 18. SPECIAL PURPOSE BORING LATHE FOR LARGE SHELLS.

able of handling to the greatest advantage.

This machine, which is being introduced to Canadian producers by the A.

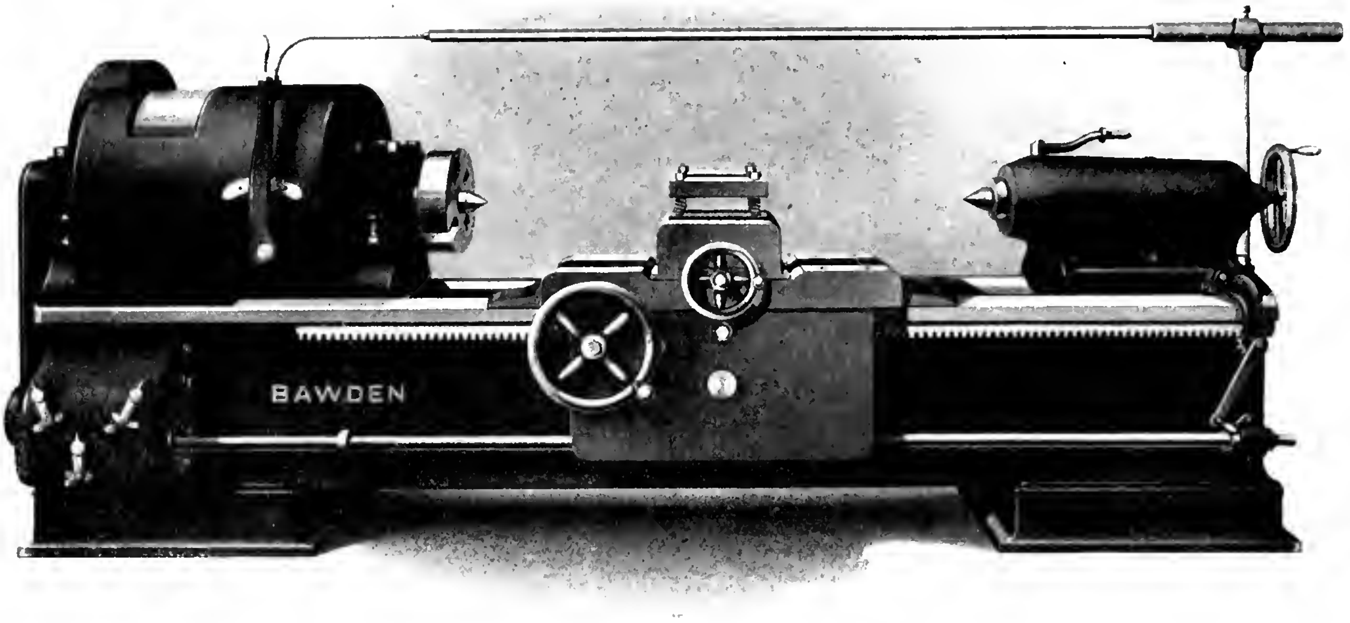


FIG. 20. TRIPLE-GEARED HEAVY DUTY SHELL LATHE WITH 26-IN. SWING AND SINGLE PULLEY DRIVE.

R. Williams Machinery Co., occupies a floor space of 5 ft. x 12 ft. and weighs 10,000 lbs. The swing over bed is 26 in. and over carriage $13\frac{3}{4}$ in.

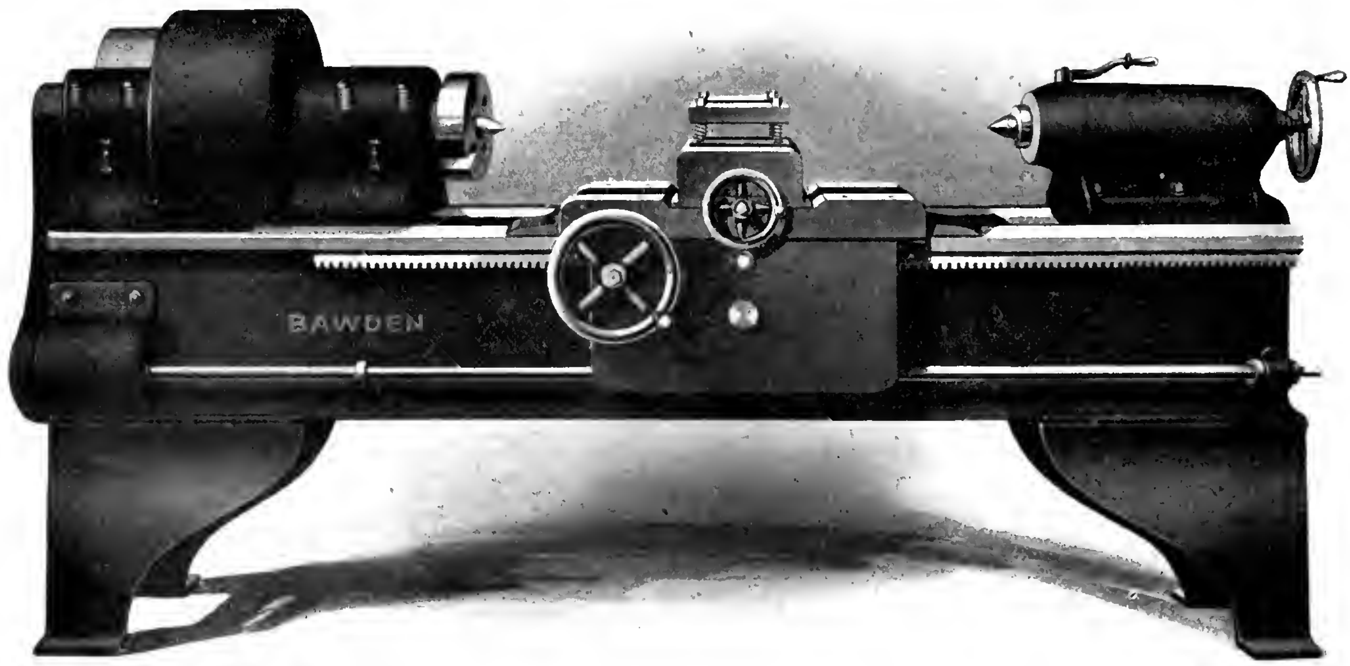


FIG. 21. 24-IN. HEAVY DUTY MANUFACTURING LATHE REDUCED TO 16-IN. SWING, FOR SHELLS UP TO 6 IN. DIA.

While the demand for lathes has been perhaps more continuous and insistent than for special purpose machines, such as band turning and threading devices, the large reserve of machines throughout the country at the origin of munitions activity prevented any immediate shortage. Since then, however, the extended scope of operations has given opportunities for the use of lathes of the plainest possible pattern.

Ample cutting power, accuracy, ability to stand up under continuous extra heavy duty, and simplicity and ruggedness of design to undergo rough treatment by unskilled labor, are the outstanding features of several lathes which are now being produced by engineering firms in various parts of the country.

Owing to the lapse of time which is necessary to the manufacture of a satisfactory lathe, these tools have not yet been completed in large numbers, but a very short time now will see deliveries

being made at a very gratifying rate.

Through the courtesy of the builders, particulars and illustrations of several

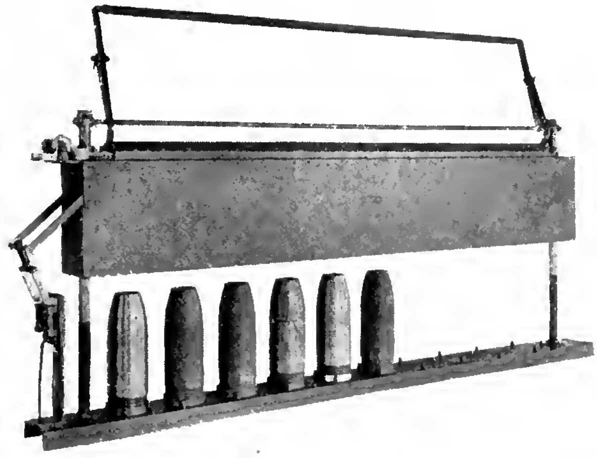


FIG. 22. ELECTRIC SHELL BAKING UNIT WITH HOOD RAISED AND SWITCH OPEN.

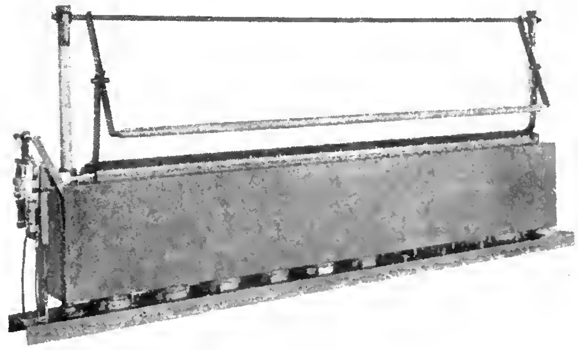


FIG. 23. ELECTRIC UNIT WITH HOOD DOWN AND SWITCH CLOSED, BAKING INTERIOR OF SHELLS.

of these lathes are published.

Engine Lathes for Large Shells

Fig. 19 is from a photograph of a heavy duty 26-inch double back-geared manufacturing lathe which is being built in this country and sold by the Canadian Fairbanks-Morse Co. It is built to meet the demand for a heavy serviceable lathe for the turning of projectiles up to 12 in. diameter.

The headstock, of the single pulley type, is of the rigid construction necessary for this class of work, the belt pulley being 20 in. dia. x 8 in. face, while the spindle bearings are chambered and ring oiled. With the use of a two-speed countershaft, six speeds are available, the back gear ratios being 11 to 1 and 8 to 1. If required, a 4-in. hole can be bored through the high carbon steel spindle which is accurately ground to size.

The bed is strongly reinforced with heavy cross ties of box pattern, and also has a longitudinal rib, having a cast rack, with which a pawl at the back of the tailstock engages, the advantage of such a positive lock being frequently apparent on heavy work.

The carriage is provided with four changes of feed from 1-32 in. to 1/8 in. power, and hand feed, both longitudinal and cross, being supplied. A square turret tool box is regularly furnished on the cross slide.

When supplied with a 12-ft. bed, this lathe weighs about 15,000 lbs., and takes in 60 in. between centres. The spindle has a front bearing 8 in. dia. x 10 in. long; the nose is 7 in. dia. with three threads per in.; and the centres fitted are No. 6 Morse taper. Regular equipment includes countershaft and necessary wrenches.

Fig. 20 illustrates a heavy duty lathe with a triple-geared head for shells from 8 in. to 12 in. dia., which is being produced by the Bawden Machine Co. of Toronto. The geared head is furnished with four-speed changes, with positive drive dog-tooth clutch. The belt pulley is 23 in. dia. x 7¼ in. face; the steel gears having a ratio of 26 to 1 and 18 to 1, all gears in headstock being bronze bushed. The high carbon steel spindle is hardened and ground and regularly furnished with a 2½ in. hole, the front bearing being 8 in. dia. x 9½ in. long.

The carriage has a bearing on vees of 42 in., and is regularly equipped with a heavy plain rest, with 4-post tool holder. Hand cross feed to slide with automatic longitudinal stop to carriage is standard.

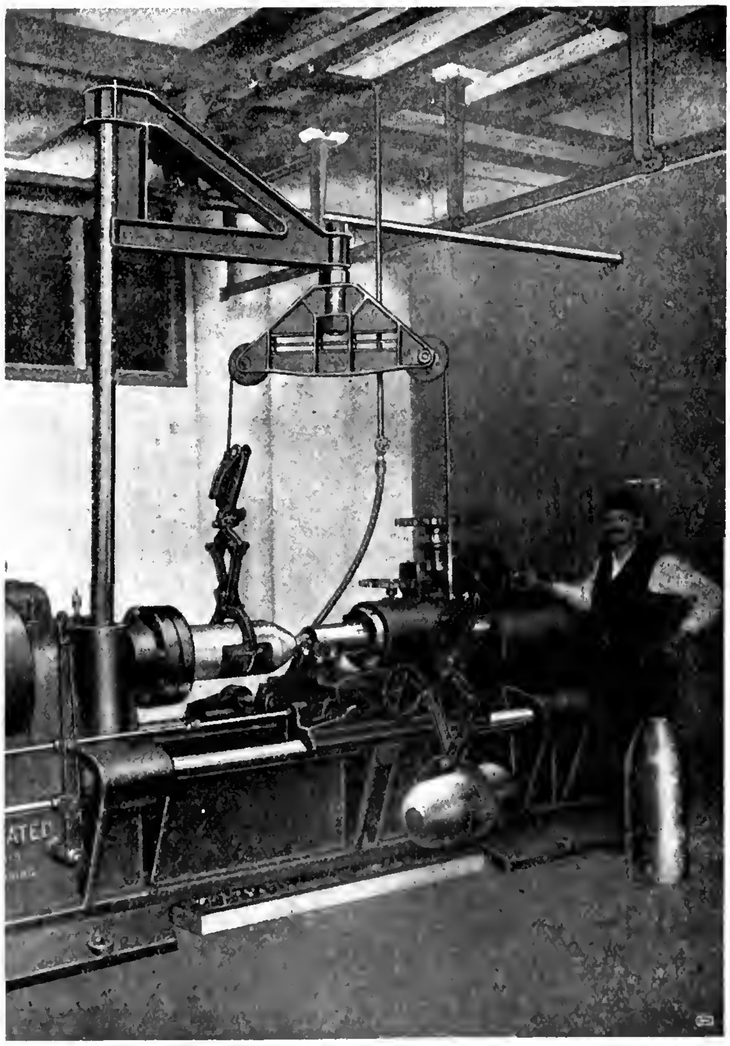


FIG. 24. POST CRANE WITH BALANCED TACKLE FOR LARGE SHELLS.

The quick change feed box supplies six feeds from 1-32 in. to 3/8 in. per spindle revolution, being driven by silent chain from spindle, and also containing feed reverse. The bed is very liberally proportioned, the width on top from front to back being 35 in., with two vees, one carrying the carriage and the other the tailstock. Planed surfaces are provided for receiving forming attachments, etc., on the back.

The tailstock is particularly rigid and carries a 3½ in. spindle. Both centres are No. 5 Morse taper. A driving face plate, plain tool post, and two-speed countershaft, with friction pulleys, complete the regular equipment.

Extra equipment can be supplied as follows:—Waving attachment, profiling attachment, 4 and 6-tool turrets on carriage, and 6-hole turret on bed.

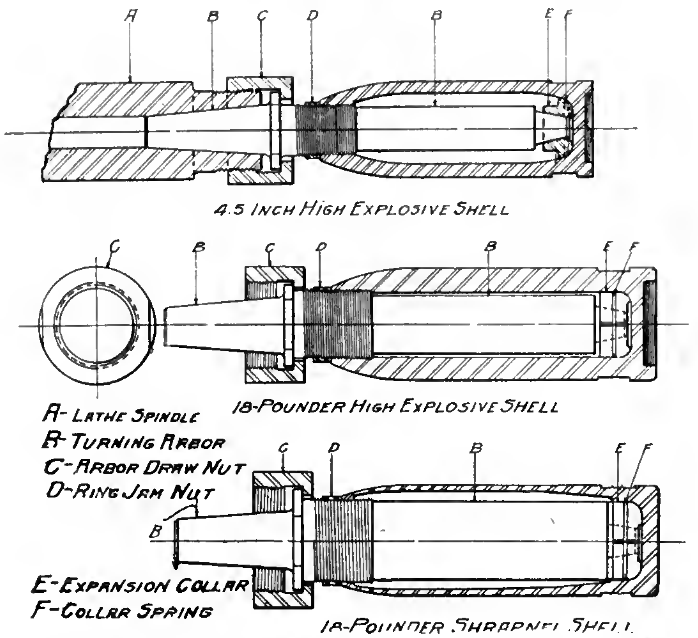


FIG. 25. SHELL ARBORS WITH EXPANSION NOSES.

The tailstock is a heavy offset pattern, with three heavy clamping bolts clamping the full length of bearing on the vee, and the spindle is 4¼ in. dia., having 9 in. travel with double thread on screw for quick traverse.

Complete equipment, including countershaft is supplied, the approximate shipping weight being 15,000 lbs. Extra equipment furnished to order includes taper attachment, forming or profiling attachment, waving attachment, four turret tool post, and heavy carriage turret.

Medium Capacity Lathe

For machining shells up to and including 6 in. size, the Bawden Machine Co. are also building a smaller size lathe, weighing approximately 3,550 lbs. This machine (see Fig. 21) has a bed 8 ft. long, swings 16 in. over vees and 10 in. over cross slide, the entire specifications, with the exception of the swing, being those of a 24 in. heavy duty lathe.

The single pulley has a diameter of 12 in. x 6 in. face, transmitting the drive through back-gearing with a ratio of 6½ to 1 to the spindle which has a front bearing 4½ in. dia. x 8 in. long. The bed is of the extra heavy duty type, 20 in. wide on top, with two vees like the larger machine.

A Unit Baking Oven

Baking ovens of large capacity, heated either gas or electricity, have been almost universally adopted for baking the enamel in the interior of high explosive shells. With the increase of size, the dead-weight of a load of shells has gone up very much. In addition to this, the use of large ovens for less than a full charge means a loss in economy, as full loads must be handled to get the most efficient use of the heat.

Other features become more marked as the shells increase in size, and interest accordingly attaches to a unit type of electrical heater, which overcomes troubles, such as broken lots, irregular operation, etc., recently developed by the

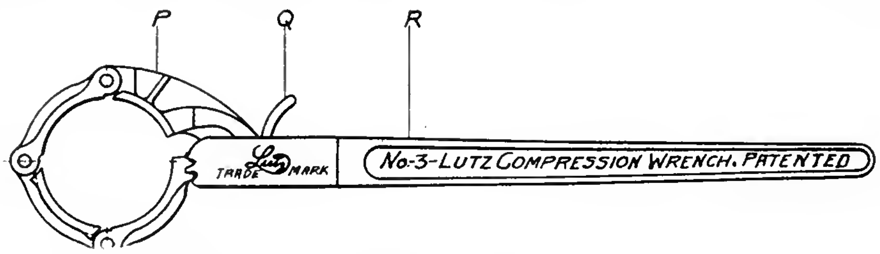


FIG. 26. COMPRESSION WRENCH WITH INTERCHANGEABLE GIRTHS FOR 3 IN. TO 8 IN. SHELLS.

Consolidated Car Heating Co., of Albany, N.Y.

This unit construction has been designed to withstand severe usage such as will be met with in baking large shells. The illustration, Fig. 22, shows the unit with the hood raised, the simplicity of construction being readily apparent. The shells rest on a channel iron base, above which is a sheet metal asbestos-lined hood containing the heating elements. When this hood is lowered into working position, the elements enter the interior of the shells, where they radiate the heat directly on to the surface to be baked, while the hood prevents excessive loss by radiation to the atmosphere.

Considerable economy in the use of current is thereby obtained, the time of baking in large ovens being reduced from eight hours to one and one-half hours.

Automatic control of the current is obtained through the control switch on the end of the hood. As the hood is raised to remove work, the switch is opened, preventing unnecessary waste of heat, and is closed again when hood is lowered.

The heating element is of a type which is giving excellent satisfaction on many electric railroads, and can be made to take any size of shell and any voltage or current up to 600 volts.

Handling Devices

The necessity for using mechanical methods in handling large shells has been promptly recognized by intending manufacturers, and satisfactory arrangements for this work will have an important bearing on the economy of pending operations.

Individual service is the principal requirement of machines in this work; any apparatus for lifting and handling must be immediately available for any machine. The use of transfer trucks with detachable platforms built for holding a suitable number of shells offers the most efficient and economical method of moving the work around the shop. The requirements of safety and care in handling render this method preferable to the use of other methods involving the use of slings or other suspension gear.

The adoption of overhead tracks depends on individual circumstances, style of shop construction, arrangement of shafting, etc., being controlling factors in deciding. The overhead installation in Fig. 18 is a good example of specialized arrangement where conditions are favorable.

All the benefits of such a system can

be obtained, however, by the adoption of single post cranes for lifting the work in and out of the machine, the moving of the work between various departments being done by any of the methods already in use.

An interesting device is shown in Fig. 22 which dispenses with the labor of operating chain blocks by hand. A 3-in. swivel post crane is mounted in a socket provided for the purpose on the headstock. At the end of the jib is a pulley yoke carrying a steel cable, at each end of which is a pair of lazy tongs. These tongs are connected to the cable by a lever which is arranged to take up a reasonable amount of slack in the cable. In operating the hoist, one pair of tongs is clamped on to the finished shell, while the other is fixed on a rough shell on the floor or truck platform. The lever is now used to take up the slack in the cable so as to lift the rough shell from the floor. As the difference in weight between the two shells is equal to the cut removed in the lathe, the operator merely has to lift this amount on the rough shell and swing it into place, while the finished shell is simultaneously swung clear and lowered to the ground, where it is safely deposited by letting out the slack on the cable. This device has been developed by the Amalgamated Machinery Corporation of Chicago, and is adaptable to any machine which can be provided with a crane.

Self-Acting Arbors

In machining shells up to 6 in. dia., frequent use is made of an arbor, part of which is threaded to receive the nose of the shell, which is then locked by a suitable driving washer or plate. The arbors shown in Fig. 23 have been specially designed for this work, and are fitted with expansion collars on the point which are brought into action as the base of the shell is tightened against them. These centre the shell accurately from the inside. The other end of the arbor is formed with a solid supporting collar, which, in conjunction with a draw nut, imparts added stiffness to the arbor.

The screwing of shells on and off the arbor is easily accomplished by the use of a compression wrench, Fig. 24. This tool has been developed by the Lutz-Webster Engineering Co., of Philadelphia, for use on shells up to 8 in. dia. The wrench handle is detachable from the girth or strap, various sizes of which are interchangeable on the same handle. The teeth on the end of the handle tighten up the girth when pressure is applied, the powerful compression gripping the shell firmly without damage to the surface in any way.

MORE CAR ORDERS PLACED

THE advancing steel market has stimulated ordering of railway equipment even in Canada, where buying has been light for some time. Another advance of 20 cents per hundred pounds will become effective on January 1st, and as a result of this several orders for equipment have been received within the last day or two by the Canadian Car & Foundry Co., while additional business is expected before the end of the month. The value of the new business was stated to be in the neighborhood of $750,000.

The increase in steel prices, although it has been gradual, has now mounted to a spectacular height. It is stated that the cost of building most classes of cars has increased 25 per cent. since last spring. The higher prices paid by car users does not, however, benefit the manufacturers, as they claim that the increase goes entirely into raw materials.

One of the new orders received by Canadian Car & Foundry Co. recently was from the Imperial Oil Co. It called for 100 forty-ton tank cars. Another was received from the Michigan Central Railroad. The Car Co. will make the steel underframes of 150 fifty-ton flat cars.

Outside of a large order for export to the British Government, very little foreign business has been closed. One order of 100 twenty-ton, end-tipping coal waggons, however, is announced to have been closed recently. The cars are for South Africa, where they are to be used on the Nigerian Railway.

BIG GUN ORDER TO UNITED STATES

THE big gun order which Canada expected to get from Great Britain as a result of an inspection of Canadian steel plants by British experts sent out for that purpose has been given in the United States. The order would have been a heavy one, and it was thought at first it would be placed in Canada, as Sir Frederick Donaldson and General Mahon, the British experts, intimated that their report on the adaptability of Canadian plants for big gun manufacture would be favorable. However, the War Office appeared to think that the remodelling of the plants would require too much time, and it has been learned that the order has since been placed in the United States.

Further Shell Orders

No further shell orders since the last big ones have yet been received by the Imperial Munitions Board, although such is the capacity of Canadian factories and machine shops that the board is in a position to handle a larger quantity than received. It is understood that representations to this effect have been made to the War Office, and it is hoped further orders will be the result. The board is also undertaking the handling of further orders placed in this country by the Allied Governments, but as far as learned has not yet received any. The Russian Government has already placed large orders, for the most part through the Canadian Car & Foundry Co., but the bulk of them have been distributed by this agency in the United States.

The French Government appears to be now manufacturing most of its own shells, and even in the United States has not lately placed any large orders. No orders for shells have yet been placed by the Italian Government, though there are said to be some in contemplation, either for distribution here or in the United States.

The last orders given to Canadian manufacturers included those for the manufacture of 9.2 and other such shells of much larger calibre than heretofore produced. As a result with the new equipment necessary Canadian factories will not be in a position to commence turning them out for some time yet in most cases.

CANADA'S TIMBER SUPPLY

ACCORDING to R. H. Campbell, director of the Dominion Forestry Branch, Canada's present supply of commercial timber has been variously estimated to be between five hundred and seven hundred billion feet, board measure, and to cover an area of approximately 170,000,000 acres. This estimate of quantity and area refers only to timber of commercial value as saw-timber. It does not include pulpwood, firewood, tie and pole material nor small timber of any description, although this has undoubtedly a very large commercial value.

The Commission of Conservation is engaged upon an investigation of the forest resources of Canada, which, when completed, will furnish the basis for a more accurate estimate of the amount of timber in the various sections.

Screwing and Tapping Aluminium.—The screwing and tapping of aluminium castings, states the Ironmonger, sometimes lead to trouble by the clogging of the chips between the teeth of the taps and chasers, but the difficulty can generally be overcome by the use of a suitable lubricant and the correct grinding of the tools. Tools used for turning and drilling aluminium should have acute cutting angles, and should be finally sharpened on an oil stone, as a keen edge is essential. Soapy water and petroleum are commonly used as a cutting lubricant. The latter enables a fine polish to be obtained, provided the cutting tool is properly ground.

The Development of Quick Acting Forging Presses--II.

By A. J. Capron, M.Inst. C.E.

The accompanying article formed the subject matter of a paper presented at the International Engineering Congress, San Francisco, last September. Recent progress and present status of the art of forging, together with the relative advantages of the quick-acting forging press over the steam hammer, constitute the salient features of the detail contents.

PART 1 of this article which appeared in our December 16 issue discussed at some considerable length the operation features of quick-acting forging presses. In the present instance, the wide variety product they can successfully handle is brought under review.

Fig. 3 represents a solid turbine-spindle forging made from an 80-in. (2,000 mm.) octagon ingot, weighing 116 tons, the finished weight of the forging being 55 tons.

Fig. 4 represents a turbine-drum, forged and expanded, made from a 64-in. (1,600-mm.) diameter ingot, weighing 85 tons, the weight of the forging being 35 tons.

Fig. 5 represents an hydraulic cylinder, forged and expanded. This forging required an 80-in. (2,000-mm.) ingot, weighing 116 tons; the finished weight of the forging was 63½ tons, and its rough machined weight as illustrated 42 tons. Its principal dimensions were:—

Length, 14 ft. 1 in. (4,200 mm.).

Diameter over collar, 6 ft. 6½ in. (2,000 mm.).

Diameter of body, 5 ft. 7 in. (1,700 mm.)

Diameter of bore, 46 in. (1,170 mm.).

For general forging work, all large presses, down to 2,000 tons power, should be fitted with mandrel gear, as that greatly facilitates the work under the press and the handling of the forgings. It can also be used conveniently for changing the tools when transverse tool-changing gear is not included in the equipment. For medium size presses of from 1,000 to 1,500 tons, a simple form of mandrel gear is often desirable and is generally well worth the comparatively small additional cost. Amongst the special classes of work for which presses have recently been adopted may be mentioned the following:—

Tyre Forging

For slabbing and punching tyre blanks presses have been adopted with very satisfactory results. Apart from the economical side of the question, it has been proved that tyres forged under the press give distinctly better results under test than the same steel forged under the hammer, and with the very high tests now called for in such material this is very valuable. The power of the press generally used for this purpose varies from 1,200 tons to 2,000 tons, but in one instance a press of 5,000 tons has been put down for this class of work. A press of this power can slab the largest tyre blank at a single stroke, and so is capable of a very large output. A 1,200-ton press, without any mechanical appliance for handling the blanks, has produced as much as 40 tons of wagon tyres, of 200 kilogrammes apiece, in an 11-hour shift, and 48 tons of locomotive tyres, of 600 kilogrammes apiece, in the same time.

More power is, however, preferable for this class of work, and recently presses of 1,500 and 2,000 tons have been more generally used. The most recent instance is a 2,000-ton press fitted with a manipulating gear and rotating table. The latter, which is mounted on a slide, enables the piece to be carried under the press and slabbed very rapidly by successive strokes, and the manipulating gear centres the blank so that the top punch can be entered correctly and then lifts it on to the bottom punch, ensuring a hole truly central and without the formation of any fin. This gear entirely dispenses with any manual work in handling the piece under the press, and also greatly increases the output.

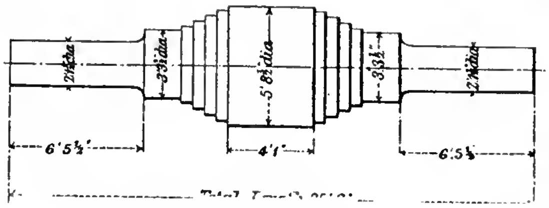


FIG. 3. SOLID TURBINE SPINDLE FORGING.

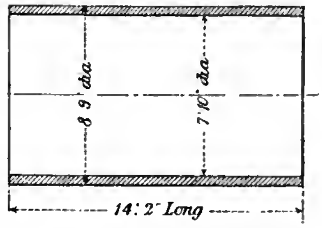


FIG. 4. TURBINE DRUM FORGED AND EXPANDED.

After the slabbing and punching, the tyres are frequently passes straight on to a roughing-mill before the final rolling in a finishing mill, but in some cases a second press is used for becking or expanding the tyres before rolling. This has the advantage of closing the material which has been stressed to some extent on periphery by the slabbing. For this process a press of from 500 to 800 tons is generally used, and is capable of an output of from 40 to 50 tons in a shift.

Disc Wheels

During the last few years the use of disc and Schoen wheels has extended very greatly, and consequently the forging of these is a matter of very considerable importance. For the forging of these, two methods have been adopted. One method is to use a press of sufficient power to forge the wheel in one or two operations, the top tool covering the whole surface of the wheel in the final squeeze. This necessitates a very powerful press, generally of about 8,000 tons. By the use of the quick-acting press, such wheels can, however, be forged under a press of much smaller power.

In several cases a 1,500-ton press, fitted with a rotating table for revolving the work, has been used. The top tool, which is about 300 mm. (12 in.) wide, is then made to the section of the wheel, so that, as the blank revolves, the successive strokes of the top tool on its surface shape the forging, and spread it over the whole surface of the bottom circular tool. This method effects a great saving in the first cost of the plant required for such work.

Axle Forging

In the past, axle-forging has been done chiefly under hammers, it being easier with hammers to get rid of the scale, and consequently to obtain a better surface. In several cases recently, quick-acting presses have been used for the first process of cogging the ingots and forging the axles roughly to shape, and as some governments and many railway companies require in the case of pressed forgings only half the sectional reduction that is called for when the ingots are cogged in a rolling mill or under a hammer, the use of a press for this purpose is additionally advantageous. The output of an 800-ton press in cogging from the ingot and rough forging is from 20 to 30 tons of axles in a shift.

For finishing axles, the difficulty of the scale, mentioned above, presents itself; but this has been to a great extent got over by the use of bracken or other suitable substance for detaching the scale, and by making the tools sufficiently wide

to prevent the scale which is detached from being pressed in. The finishing tools have generally three grooves about 12 in. (300 mm.) apart, and to obviate the objectionable side stresses that would come on the press when finishing in the outer grooves, an arrangement has been adopted of mounting the tools on slides worked by power, so that the top and bottom tools move simultaneously, and the grooves in use can be brought instantaneously to the centre of the press. For the first process of cogging and rough forging, the use of presses has proved very advantageous, and it seems likely that their use for finishing axles may also extend.

Cogging Ingots

Many presses have already been put down for the purpose of cogging ingots for special manufactures, the powers of press generally used being from 600 to 1,200 tons. Trials on special steels have proved that much better results are obtained by cogging such material under the press than by hammering or rolling. In the case, however, of steel of ordinary composition, but which is required to be of specially close and uniform texture, as, for instance, for the manufacture of material which has to be drawn, it is found that cogging under the press, prior to the subsequent processes of rolling and drawing, produces a very great improvement in the texture of the steel. So marked is this improvement that in some cases a comparatively small reduction under the press in the original sectional area of the ingot proves sufficient to give the desired result.

Shell-Forging

For the purpose of forging externally armour-piercing shell up to the largest calibres at present required, quick-acting presses of from 1200 to 2000 tons have been used to a considerable extent. For the processes of piercing and drawing, which require a long continuous stroke, purely hydraulic presses worked from an accumulator are much more suitable.

General Forgings

For the production of engineers' and other general forgings an up-to-date quick-acting press has really no competitor. Its general advantages over the steam-hammer have been already enumerated, but it is only by experience of its capabilities in actual use that its superiority can be properly realized. For the manufacture of forgings of simple form where large quantities are required, dies can be used, and in many cases the forgings can be produced by a single stroke of the press. Dies can often be used in the case of forgings of more complicated form; but then it is generally necessary to forge the piece roughly to shape before using the dies to produce the exact shape and dimensions required. This point is particularly mentioned because die forging can be done much more advantageously under a press than under a hammer, providing there is a fair body of metal.

Generally speaking, it is only quite small forgings, and especially those of very light section, which are best made under a hammer or drop-stamp. With a press, the tools and dies can be of a cheaper and lighter construction, and they last much better than when used under a hammer. For many special manfactures requiring a considerable number of similar forgings, so that special tools and dies can be provided, the use of high-speed presses has proved extremely advantageous. Amongst such applications which have already been made, the following may be mentioned:

For locomotive and railway works, for general small forgings, including coupling and connecting rods, presses of 150, 500 and 600 tons.

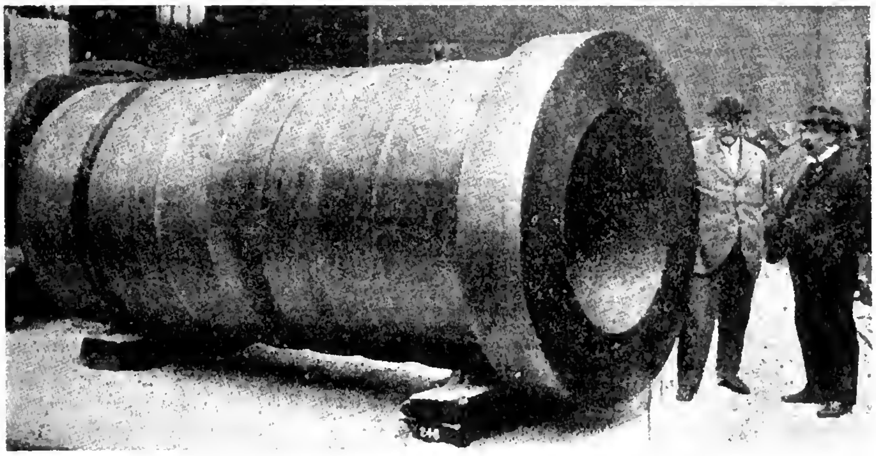


FIG. 5. AFTER ROUGH TURNING, FORGED AND EXPANDED HYDRAULIC CYLINDER AFTER ROUGH TURNING.

For stamping crossheads and other forgings required for boiler-feed pumps, a 600-ton press.

For stamping field-gun carriage forgings, a 500-ton press.

For bridge and structural work, for such as stamping link ends, presses of 150 and 300 tons.

For shipbuilding works, 300 and 500-ton presses.

For anchor-forging, an 800-ton press.

For forging well-boring tools, an 800-ton press.

For the manufacture of tires of a flat rectangular section for road vehicles, for the first process of slabbing and punching, and for the second process of expanding or becking, presses of 400 tons, of special construction.

Apart, however, from special application, presses of small and medium powers are beginning to be used to a very considerable extent for general engineers' forgings, both in forges and in engineering works. The powers that have so far been used for this purpose in engineering works range from 150 to 800 tons, and in forges up to 1500 tons, and it can be safely stated that such presses have proved generally very profitable.

In an engineering works it is often preferable to have the facility for producing the smaller forgings especially required when repair work is undertaken, and the much wider range of work that can be done under a press than a hammer is a substantial advantage.

In a forge, it is desirable to have a sufficient proportion of presses of medium power, as it is generally possible to keep such presses more uniformly employed than the heavier presses, and the production is naturally more economical when the power of the press is proportionate to the size of the forging.

In several cases, 300-ton forging-presses have been installed in steel-rolling mills for doing general repairs, and they have proved exceedingly serviceable for this purpose in enabling breakdowns, which are liable to occur with such machinery, to be dealt with very promptly on the spot, and thus greatly reducing the stoppage of the mill or other plant.

Another application which is of interest is the use of quick-acting presses for the manufacture of iron from the puddling furnace. With presses of sufficient rapidity of action, very satisfactory results have been obtained both in quality and output, the powers of presses generally used for this purpose being 400 and 500 tons. For naval repair-ships, forging-presses of a specially compact construction have been used, generally of 150 tons power. The advantages of a press for this purpose are that, unlike a hammer, its working causes no inconvenient vibration or damage to the structure of the ship, and that it is capable of dealing with repairs of a far more extensive character.

In conclusion, it may be stated that the superiority of presses over hammers

for the heavier classes of work has been recognized for the past twenty years, and their use frequently adopted; but within the past ten years, owing largely to improvements in construction, and particularly to increased speed of working, their use has become much more general, and it is only within this latter period that presses of medium and small powers have proved a practical success and have begun to be freely adopted.

Forging-presses of all powers, and particularly of medium and small powers, will undoubtedly come into much more extensive use in the near future, as foreshadowed by the advance made during the past ten years, and more especially because the increased speed of working that has been attained opens so much wider a field for their useful application.

THE USE AND ABUSE OF OILS.—I.*

By T. C. Thomsen, B.Sc.

THE owners of many large plants have seen the advantage of having an engineer responsible for the lubrication of their engines and machinery, and in plants which are not large enough to justify the employment of an engineer for this particular work, it has been found advantageous to have a lubricating engineer to inspect the plant occasionally, report on the lubricating conditions, and offer suggestions as regards economy and saving in power.

Many large concerns, when inviting tenders, specify certain chemical attributes in the oil. This practice is wrong, because chemical readings do not show the lubricating properties of an oil, for the reason that it is possible to duplicate a high-grade oil on the basis of chemical tests by means of an imperfectly manufactured and inferior article. Although the chemical tests may be the same for the two oils, the results can be widely different in actual work. The only accurate way of testing lubricants is to try them under working conditions, where they are to be actually used.

High-grade Oil and Lubrication Cost

The question might be asked whether introducing a higher grade of oils would not increase the total cost of lubrication. Experience has proved that in a large number of plants the costs of lubrication over a period may even be lower than with lower grades of oil in use. In other cases the cost may possibly work out a little higher, but this increased cost will be balanced by other benefits. It is here that the services of a lubricating expert become desirable. He should select high-grade oils for the portion of the plant where such oils could be used to advantage, and if the lubricating conditions are not favorable to the introduction of high-grade oils, he may suggest ways and means by which better lubricating appliances or better methods of handling oil can be introduced, so as to make the introduction of better grades of oil possible.

When talking to men directly interested in the successful running of machinery, one is often assured that they have no trouble; the idea being that the machinery is operating without any unusual heating of bearings or engine parts. In many such plants, however, the mere change from low-grade oils to better grades has effected a saving in power of 20 per cent., and it is now realized that there is something beyond having "no trouble." A troublesome bearing in nine cases out of ten will not indicate that the oil is unsuitable, but that some mechanical defect exists in its construction. It is not an occasional hot bearing, but the few degrees of unnecessary frictional heat that are wasted in hundreds and hundreds of bearings that determine real standard of lubrication.

Testing Influence of Better Lubrication

The actual testing of the influence of better lubrication on a power-house plant is a difficult matter, as there are so many other conditions that may influence the results. By means of accurate temperature tests it is, however, possible in nearly every case to make a comparison between the lubricating qualities of different oils, and it is recommended to make such tests as thorough and as careful as possible on specially selected important bearings. These temperature tests should be repeated from time to time with a view to controlling the quality of the oils in use. If the mechanical conditions do not change, the rise in temperature of the bearings above the surrounding atmosphere should remain nearly constant.

When a new motor exhibits a tendency to develop heat in one bearing, the bearing should, of course, be examined. If it is found in good condition, the cause of the heating will probably be found in the thrust of the armature shaft against the bearing, which may result from either of two conditions: First, the machine may not be level, and the armature shaft may dip towards that end. Second, the magnetic centres of the pole-pieces and armature shaft may not be in line.

Where low-grade mineral oils, or oils with mineral base, but compounded with animal or vegetable oils, are employed, they will develop gumminess in the bearings, and necessitate frequent cleaning. Such cleaning is unnecessary when high-grade dynamo oils are employed; cases have been known where such oils have been in use for years without any necessity for cleaning the bearings and oil wells. However, it is desirable to empty the bearings every three or four months and put the oil through a suitable filter. It will then be as good as new, and can be used over and over again, being mixed with a little fresh oil to make up for loss.

*From a paper read before the Association of Mining Electrical Engineers.

CAST VANADIUM STEEL DIES

THE use of alloy steel castings for dies has lately come into prominence due to important developments which have been made in the last years by steel foundries specializing in such material. Cast steel dies are now being used by drop forging manufacturers, by plow manufacturers for making plowshares, and by sheet metal workers for forming dies in the production of sheet metal specialties, kitchen-ware, etc. Various alloys have been tried for cast steel dies, but, according to C. R. Messinger, vice-president Sivyer Steel Castings Co., Milwaukee, the most satisfactory material so far introduced is vanadiem carbon steel.

The Sivyer Company has made a specialty of cast vanadium carbon dies under the name of "Sivyer" die steel. Exceptional wearing qualities are reported, together with unusual resistance to cracking or breaking under the battering to which dies are subjected. For example, a run of 40,000 automobile brake support forgings 20 in. long, was made from a pair of Sivyer dies without, it is stated, any great amount of wear. In another instance, a plow manufacturer claims that his dies last at least six times longer than cast-iron dies for forming plowshares, and are considerably cheaper than hammered blocks.

For general drop forge work the company considers the best practice is to cast the dies with the tenons and with the impressions for breakdowns approximately to shape, allowing a small amount for finish. The impression for the die is then sunk in the solid block. For plain forgings, the impressions also are sometimes cast in the dies, allowing some metal for finish. In dies for making plowshares the entire impressions are cast in the dies, allowing about ¼ inch metal for finishing. Forming dies for sheet metal work are also cast approximately to shape with some allowance for finishing.

After annealing and machining, the general practice with cast vanadium dies is to heat to 1500 or 1550 deg. Fahr., and quench in oil for a fairly hard surface and in salt water for a hard surface. In most cases no additional heat treatment is required; that is, the temper should not be drawn.

Cast vanadium dies, it is explained, generally cost a little more per pound than hammered carbon blocks. However, it is held that the saving in material from casting approximately to shape more than counterbalances this, and in addition there is less material to be removed.—Iron Age.

The Lay-out of Ships Ventilator Cowls, with Girth Seams

By J. W. Ross

While the methods described in the accompanying article have immediate reference to work in connection with shipbuilding, the adaptation of the principles involved are applicable to many manufacturing lines. Exhaust systems in shops and mills offer occasional instances where such work may be necessary, but the fact that such instances are occasional, renders a clear understanding of the procedure to be followed all the more desirable.

THE perspective view, Fig. 1, shows a girth seamed ventilator cowl. Its visual effect is not so pleasing as that of the hammered or blocked out type with the longitudinal seams. However, its chief advantage lies in economical construction.

The Outline Construction

Measure off the base line, A B, Fig. 2, equal to 20 inches. Locate the point C on the continuation of the base line, equal to ½ the distance of A B. With centre C and radius C B, strike the quadrant B E. The point D is located by measuring from C a length equal to half the distance B C. Erect the perpendicular F D. With radius equal to twice the length of A B, and at centre E, strike the arc to intersect the perpendicular D F, thus locating the point F. Connect F to E. With radius equal to D A and with F as centre locate the point G. With G as centre and the same radius strike the quadrant F L H, tangent to the perpendicular A J.

In this cowl there are five courses. Count each end course as one and the intermediate courses as two each. Therefore this total of the courses will be 8. Divide the outline A K L F into 8 equal parts. At the first division point locate J. Then take two parts and locate K. Two parts again for L. Similarly for M. Divide the quadrant B E into the same number of parts.

The point W is located at the first division point. P is denoted by taking two parts; similarly locate the points Q and R. Connect the points J W, K P, L Q and M R. These lines are rivet lines. Bisect the rivet lines, locating the points X, S, T, U, V and W. Connect the points A to J, J to K, L to M, and M to F, by straight lines. These lines are drawn in showing each course with its overlaps, looking downwards. Connect the points on the throat in a similar manner. This completes the side elevation.

The front elevation is projected over, although it is not essential to the development of the patterns.

Prolong the base line A B to Fig. 3. Erect the perpendicular X^1 F^1. Draw the projecting line F F^1 parallel to A X^1. This locates F^1. Also parallel to A X^1, project the point W, Fig. 2, to its intersection of the axial line X^1 F^1, thus locating W^1. With centre W^1 and radius W^1 F^1, draw the circle defining the mouth of the cowl.

By parallel line to A X^1 project over all the centres S, T, U, V, Fig. 2, to the

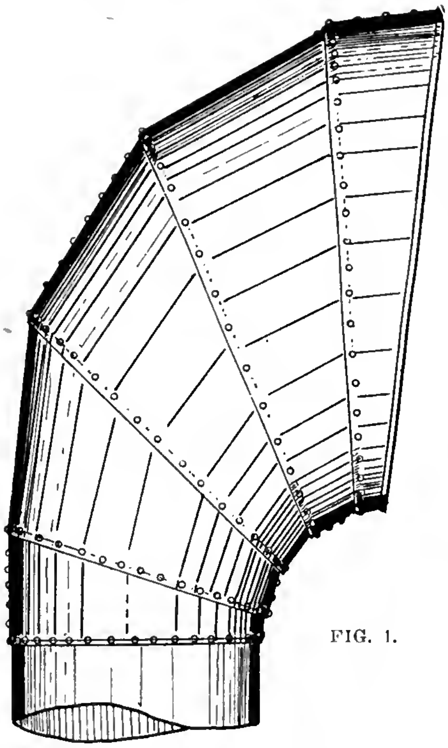


FIG. 1.

points S^1, T^1, U^1, V^1, Fig. 3. With radius V M Fig. 2, and centre V^1, mark off the distances V^1 V^2. Measure off U^1 U^2, Fig. 3, equal to U L or U Q, Fig. 2. Similarly locate the distances T^1 T^2, S^1 S^2 and X^1 X^2, Fig. 3, by the respective distances T K, S J and X A, Fig. 2. Connect the points X^2 to S^2, S^2 to T^2, T^2 to U^2, U^2 to V^2 and V^2 to W^2. This completes the front elevation.

Triangular Construction

As no two courses are alike, a separate development will be required for each course. One of the courses, therefore, will be herewith developed, the others being developed in precisely the same manner.

Let course III be selected for development. To save confusion of lines, transfer carefully the outline of the course III —as represented by the letters K, L, U, Q, P, T—Fig. 2, over to Fig. 4.

With centre T and radius T K or T P describe the half section view K 5 P. Divide this semicircle into a suitable number of equal parts; the greater the number, the more accurate the templet. In this case it is divided into 8 equal parts. Project all these points to, and at right angles with K, T, P.

With U as centre and radius U L or U Q, describe the half section view. L 5^1 Q. Divide this semicircle into equal parts, the same number as that used for the semicircle K 5 P.

Erect perpendiculars from L U Q to these division points. Number the division points on both circles in consecutive order and in relation to one another. Also number the projection points on the lines L U Q and K T P in respect to their relative projection lines. Connect the points 2^2 to 2^3, 3^2 to 3^3, 4^2 to 4^3, etc., by straight lines.

If both of the half section views were equal, these straight lines, 2^2 2^3, 3^2 3^3, etc., would be shown in the drawing by their true lengths. However, the sec-

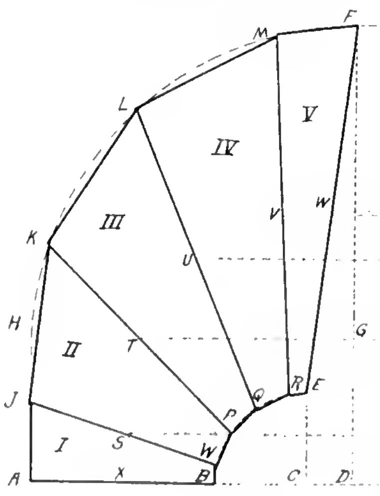


FIG. 2.

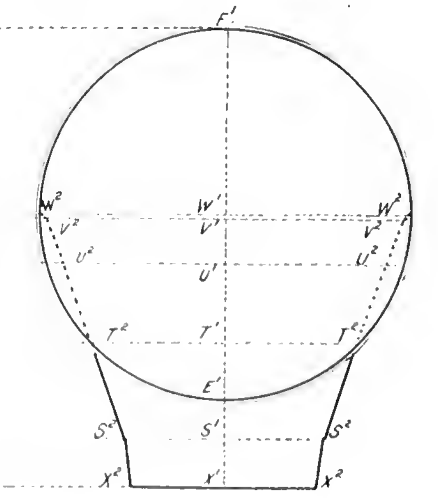


FIG. 3.

tions are not equal, therefore the lines in question will be foreshortened.

Their true lengths are found by triangulation, as follows: Draw the horizontal line 2^3 8^3, Fig. 5. Erect perpendiculars at any point, as at O. Measure off the perpendicular O 2^2, Fig. 5, equal in length to 2^3 2^2, Fig. 4. Take the difference of the lengths of the projector lines 2^2 2^1 and 2^3 2, Fig. 4. Place this difference on the horizontal line, as O 2^3, Fig. 4. Connect 2^3 to 2^2, Fig. 4. This line is the true length of the foreshortened line 2^2 2^3, Fig. 4.

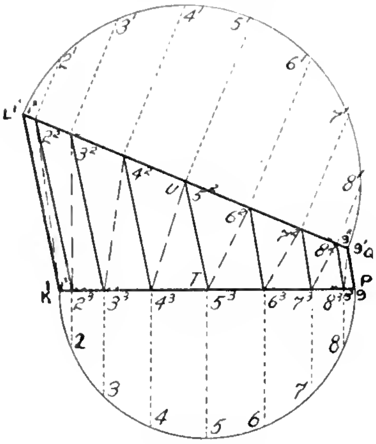


FIG. 4.

Take the distance 3^2 3^3, Fig. 4, and place it on the perpendicular O 3^2, Fig. 5. Measure 3^3 3, Fig. 4, against 3^2 3^1, and place the difference, as O 3^3, Fig. 5. Connect by a straight line 3^3 to 3^2. This inclined line, or the hypothenuse of the right angle 3^3, O, 3^2, is the true length of the foreshortened line 3^2 3^3, Fig. 4.

Again, make O 4^2, Fig. 5, equal in length to 4^3 4^2, Fig. 4. The base of the triangle O 4^3, Fig. 5, is equal to the difference in length of the projectors 4 4^3 and 4^2 4^1. The hypothenuse, 4^3 4^2, being the true length. Proceed in a similar manner with lines 5^2 5^3, 6^2 6^3, 7^2 7^3, and 8^2 8^3, Fig. 4, locating the true lengths by the inclined lines 5^2 5^3, 6^2 6^3, 7^2 7^3 and 8^2 8^3, respectively, Fig. 5.

In Fig. 4, connect the points 1^3 to 2^2, 2^3 to 3^2, 3^3 to 4^2, and 4^3 to 5^2, etc., as shown by the short dash lines. These lines are also shown foreshortened. Their true lengths are obtained in a similar fashion as the other lines. Draw the horizontal line 1^3 8^3, Fig. 6. Erect perpendiculars at the points X. Measure off X 2^2 equal in length to 1^3 2^2, Fig. 4. The distance X 1^3, Fig. 6, equals 2^3 2^1, Fig. 4. Connect by a straight line the points to 1^3 to 2^2. This line equals the true length of the foreshortened line, 1^3 2^2, Fig. 4. Transfer the distance 2^3 3^2, Fig. 4, over to the perpendicular X 3^2, Fig. 6. Measure off X 2^3 equal to the difference of the projectors 2^3 2 and 3^2 3^1, Fig. 4. The points connected, 2^3 to 3^2, by a straight line defines the true length. Again, transfer the distance 4^3 4^2 over to X 4^2, Fig. 6. Obtain the difference between the projectors 3 3^3 and 4^2 4^1, and place at X 3^3, Fig. 6. The true length is shown by the line 4^2 4^3. In a similar manner define the true lengths of the remaining dash lines.

Having obtained all the true lengths, the development of the plate will be next proceeded with.

Plate Development

In this course it is decided to have the vertical seam on the line 9 9^1. Therefore, the centre line of the pattern will be 1^2 1^3.

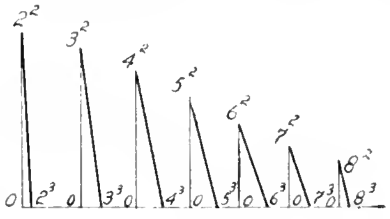


FIG. 5.

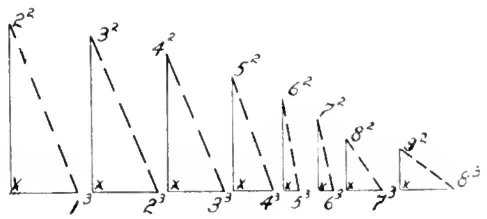


FIG. 6.

Measure the vertical line 1^3 1^2, Fig. 7, equal to its true length 1^2 1^3, Fig. 4. Set the dividers to the distance 1^3 2^3, Fig. 6, and transfer over to Fig. 7 by using 1^3 as centre and striking the arc at 2^2. By careful measurement obtain the exact length of the arc between the division points on the semicircle L 5^1 Q, as 1^1 to 2^1, or 2^1 to 3^1, Fig. 4. All the divisions being equal, it is a matter of indifference which division length is taken. With the dividers set to this distance, place one point on 1^2 and strike the intersecting arc at 2^2, Fig. 7.

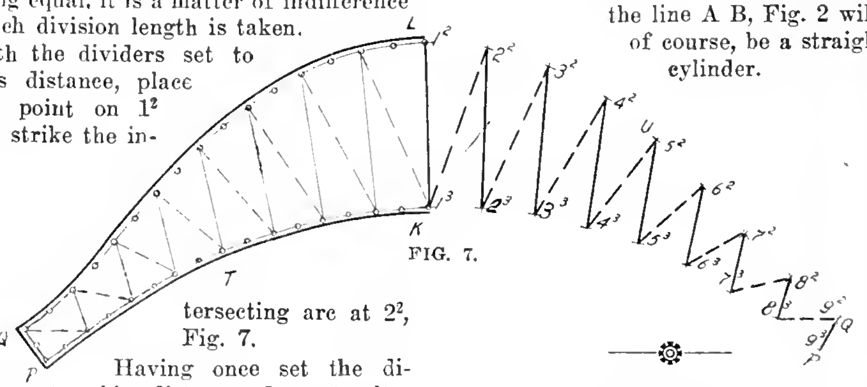


FIG. 7.

Having once set the dividers to this distance do not alter them, but put them aside for the time being. Procure another set of dividers and take the distance 2^3 2^2, Fig. 5. Transfer to Fig. 7. With one point on 2^2 strike the arc at 2^3. Now measure carefully the length of the arc, between the division points, on the semicircle K 5 P. Transfer this length to Fig. 7 by placing one point on 1^3, striking the intersecting arc at 2^3. Hold these dividers at this distance.

Again, procure another pair of dividers; that is three pair of dividers in use. With centre 2^3 and distance 2^3 3^2 equal in length to 2^3 3^2, Fig. 5, strike the arc at 3^2, Fig. 7. Now with the first pair of dividers strike the intersecting arc at 3^2. Of course, 2^2 3^2 is equal to 1^2 2^2.

With No. 3 dividers transfer the distance 3^2 3^3, Fig. 5, to 3^2 3^3, Fig. 7. With the No. 2 dividers on point 2^3 strike the intersecting arc at 3^3, Fig. 7. With centre 3^3 and radius 3^3 4^2 equal to 3^3 4^2, Fig. 6, strike the arc at 4^2. With 3^2 as centre and radius 3^2 2^2, strike the intersecting arc at 4^2, Fig. 7. Proceed in a similar manner with the remaining lines. Care being taken to have all the distances 1^2 2^2, 2^2 3^2, 3^2 4^2, 4^2 5^2, etc., Fig. 7, equal to each other, also equal to the divisions of the semicircle L 5^1 Q, Fig. 4. Then the length of the curve through the points from 1^2 to 9^2, Fig. 7, will be equal to the length of the semicircle L 5^1 Q.

Similarly the divisions 1^3 to 2^3, 2^3 3^3, 3^3 4^3, 4^3 5^3, etc., Fig. 7, are equal to the divisions of the semicircle K 5 P, Fig. 4; then evidently the curve line 1^3 to 9^3 will be equal in length to that of the stretchout of the semicircle K 5 P, Fig. 4.

On the right of Fig. 7 the construction lines are shown. On the left the curves are shown drawn in. These curves are the rivet lines to which is added suitable laps. The rivet holes are spaced off accordingly. The location points, 2^2, 3^2, 1^3 2^3, etc., may be used for rivet centres. Other centres being spaced in as desired.

This completes the templet for course III. The other courses being developed in exactly the same manner.

The continuation of the pipe below the line A B, Fig. 2 will, of course, be a straight cylinder.

Labor Conditions.—The report of the Dominion Labor Department for November indicates that labor conditions are very good, due to the war orders, the crop movement and the fine, open weather. There were only two small labor disputes, affecting less than fifty workers, one in Halifax and the other in Victoria.

NEW PROCESS DEVELOPMENTS

Inventive Genius and Research Operate to a Dual End — They Aim to Improve What We Now Possess and Bring to Our Service Commodities Before Unknown

THE MANUFACTURE OF LEATHER BELTING.—I.*

By F. H. Small.**

THE manufacture of leather belting has its beginnings on the farms of New England, the grazing ranges of Argentine, the rocky Alpine pastures of Switzerland, the fertile plains of France, and wherever cattle are raised. Cattle supply the hides which are one of the essential raw materials of the tanner and so of the belt maker, it is therefore necessary that the cattle industry should prosper if leather is to remain as universally useable a commodity as heretofore. Cattle are raised primarily for their labor value, their milk value and their meat value; the hide is very much of a by-product, and the matter of production of a hide specially suited to the requirements of the tanner is but an infinitesimal incentive to the cattle grower.

When steer hides sell at better than 26 cents a pound as they have this year, when as much as $40 per hide must be paid to secure a particular selection, it seems as though the hide, even if but a by-product, represents a sufficiently large percentage value to secure from the cattle grower an endeavor to produce a satisfactory hide. The tanner, however, has had a hard time to establish this point of view although, aided by governmental agencies whose interests have been different but objective similar, progress has been made.

Hide Imperfections

The particular evils of which the tanner has complained and for which the cattle raiser is responsible are three: barbed wire, brands and grubs. Barbed wire fences lead to scratches on the hair or grain side of the hide, which though they later heal yet constitute imperfections; branding destroys the hide fibre and makes so much of the hide as is touched by the branding iron absolutely worthless for purposes of belting manufacture; grubs are worst of all, for the reason that they do their damage in the very best part of the hide and oftentimes are so numerous that a hide affected by them gives the appearance of having been used as a target for a shot gun.

The first two evils are subject to individual correction; the last can be remedied only by concerted and widespread action. It is a question for governmental investigation and legislation. The investigation has been and is going on, but the efficient remedy is not yet, though progress is making. In one district in Denmark, for instance, where they can be reasonably autocratic, by making the presence of warbled cattle in herd punishable by fine, they reduced in six years' time the percentage of warbled cattle from 18 to 1. The above is mentioned for two reasons: first, to bespeak interest in any measures that may come to the reader's attention, calculated to improve the conditions mentioned, and second, to show you how uncontrollably imperfect is one of the tanners' raw materials.

Material Constitution of Hides

Apart from damages as cited there are material differences in hides—differences in texture, in plumpness, in uniformity, etc. It is generally true, for instance, that cattle in warm countries have thick hides and short hair, while in cold climates the reverse is true. The supply of first quality, extra heavy hides comes almost wholly from Southern Europe, and these being no longer obtainable as a consequence of the war we are hard put to it to produce extra heavy leather. Some cattle have hides which are very thick over the kidneys and thin over the shoulders; others show this difference much less markedly.

When the hide is removed, the way in which it is done is again a matter of keen interest to the tanner. Cuts in the hide made by the butcher when taking it off the animal lessen the value very materially. The take-off of hides from the large packing houses is usually excellent, the result of specific attention, carefully trained and expert labor. It is quite otherwise with the average country hides taken off by the town butcher, which despite the efforts of the Tanners' associations, are still a source of shame. The flaying is so bad that they rarely bring the price of a packer hide, and they represent a real and needless economic waste. Abroad, methods of so-called mechanical flaying have been introduced to avoid butcher cuts. By these methods the hide is pulled and hammered from the carcass and such hides usually command a premium, 50 cents a hide being an average figure at the Paris auctions.

Hide Preservation

What happens to the hide after its removal from the animal and before the tanner gets it, is again of importance. Hide, being essentially gelatine, readily spoils and must be preserved against decomposition. Two methods of preserving or curing hides are in vogue, viz.: drying and salting. The first is ordinarily too uncertain to permit of the use of hides cured in this way for belting, and practically all hides tanned for belting are what are known as green-salted hids.

If the belt manufacturer tans the leather which he makes into belting—and this is the ideal arrangement—he buys so far as possible green-salted hides, free from scratches, brands and grubs, short-haired, of as uniform thickness as obtainable and which have been skilfully taken off, so that they are free from butcher cuts; i.e., the manufacture of first quality belting begins with the purchase of first quality hides.

Initial Tanning Operations

Before being used for belting the hides must be tanned, i.e., so treated that they will not decompose or spoil and will remain flexible. There are various methods of tanning hides but whatever the method used, the first steps, usually spoken of as the beam house treatment, are essentially the same, namely: preliminary washing with water to remove dirt, and the salt or other material which may have been used to cure the hide; a cleaning of the flesh side to remove superfluous flesh, fat, etc., left on in the flaying—a soaking in milk of lime, or some other depilatory solution, to loosen the hair which is then pushed off by machine or with a dull two-handled knife; and a final washing to remove at least in part the unhairing chemical and to clean the hide. The quality of the finished leather depends in very large measure on the successful performance of these apparently simple operations. It is an old saying that leather is made in the beam house.

The conversion of the hide as above prepared into leather may be brought about through the use of any one of a variety of tanning materials, the peculiar characteristics of the finished leather being governed by the material used. Only a few of these materials will be mentioned and such only as have a special interest to the belt manufacturer.

One of the simplest and oldest methods of tanning is to cover the raw hide in the moist condition with grease and then continually manipulate it as it dries, thus working the grease into the inmost fibres of the hide and producing a grease-tanned leather. Grease-tanned leather has little more fullness or body than the original hide, but it is excep-

* Presented at the annual meeting of the Providence Association of Mechanical Engineers (A.S.M.E. Affiliation), September 22, 1915.

** Chemist, The Graton & Knight Mfg. Co., Worcester, Mass.

tionally strong. The so-called mechanical lace used for lacing together belting is tanned in this way.

Another method of tanning which has come down to us from olden times is to work into the hide a mixture of alum and salt. This gives a somewhat fuller leather than grease and is used before the grease treatment by some tanners of mechanical lace because of the fullness gained, but it is at the expense of the toughness and wearing qualities of the lace.

A modern tannage of somewhat similar nature is that with salts of chromium the hide being immersed in a solution of one of these salts. Chrome tanned leather is fuller than alum tanned and much more permanent. Water will seriously injure alum-tanned leather, causing it to revert nearly to the condition of raw hide and to become hard and cracky, whereas water has little or no effect on chrome leather. Chrome leather may even be immersed in boiling water for some little time without serious damage to the leather. Most of the so-called steam-proof belting is made from chrome-tanned leather.

Vegetable Material Tanning

By far the greatest percentage of heavy leather, and in particular that used for belting, is tanned with a tannin derived from some vegetable material. The procedure of the tanning process as early practised with vegetable materials was to spread the hides out flat in a vat with a relatively thick layer of the tanning material between the hides, the vat finally being filled with water. The water served as a medium of exchange, extracting the tannin from the vegetable material and giving it to the hide which absorbing it became tanned. The process was slow, often necessitating a year or two to effect the conversion of the hide into leather.

An improvement in the process was effected by substituting for the water a tan liquor obtained by leaching the tanning material in large tubs; i.e., extracting the soluble tannin by passing hot water through the ground raw material. Nowadays the use of the raw tanning material by the tanner is almost a thing of the past. He uses instead tanning extract prepared at plants usually located where the supply of raw material is abundant and which is a concentrated solution of tannin obtained by leaching the raw material with water as was formerly done at the tannery, and then evaporating away much of the water in a partial vacuum at low temperature and yielding as the commercial product ordinarily a thick brown liquid containing about 25 per cent. actual tannin.

Not merely does this supply the tanner with his tanning material in a form much more convenient for use, but it has the further decided advantage that the extract admits much more easily of analytical control and so makes possible the use of a determinate and uniform tanning agent. Since uniform product demands uniform raw material this is an improvement of no mean order.

Enumeration of Vegetable Tanning Materials

Not so long ago—in fact as recently as 1890—practically all the vegetable tanned heavy leather in this country was made with either hemlock or oak bark, or a mixture of the two. Now, while the old names, hemlock, oak and union, are still retained, it would be hard to find a tanner making leather with these materials alone. The present-day tanner uses not merely hemlock and oak, but chestnut wood, or valonia, or myrobalans, or mimosa, or quebracho, or wattle, or mallet, or algarobilla, etc., some twenty-five or thirty materials being commercially available.

With an increased range of materials came, of necessity, a study of the leather-making qualities of each. Marked differences appeared. For instance, the tannin of valonia was found to decompose rather rapidly, forming and depositing insoluble ellagic acid. The English tanner, earlier to use these materials, had discovered this by experience, and by using valonia and insuring the deposition of the ellagic acid in his leather, was making the solid English sole, water-proof and long-wearing, which earned him a reputation the world over. A myrobalan liquor was found to sour very rapidly, yielding eight times as much acid, for instance, as mimosa under the same conditions.

The leather-forming value of the materials varied; valonia would produce over 100 lb. of finished leather as against 75 for myrobalans, from the same weight of hide. Chestnut wood produced a leather of tensile strength over 3,000 lb. to the sq. in., while oak bark under similar conditions gave one of less than two. Here certainly was knowledge and opportunity the tanner could not neglect. Knowing what qualities he desired in his finished product, he could, by a careful selection of tanning materials, go far toward securing these qualities, this material making for fullness, that for strength, etc. The progressive tanner, who wanted to make the best belting leather could not afford to make oak belting with oak bark alone, and he did not, and his leather is the better in consequence.

Final Leather Constitution

The objection to practically all the tannages, aside from that with vegetable tannin, is that they do not make a plump, full, solid leather. The leather produced by them is tough, but thin and open. The original hide constitutes much the largest percentage of the finished product, only a small quantity of the tanning material remaining in the leather. This is in marked contrast to the vegetable tannage in which so much tannin and other matters is deposited in and on the fibres of the hide that the original hide constitutes less than 50 per cent. of the final leather.

Lack of firmness is a serious deficiency in a leather to be used for belting. Nevertheless, leathers made with some of the above materials have sufficiently valuable properties so that they have made considerable headway for belting even despite their failings. Chrome leather, for instance, can be produced in a comparatively short time. It will run practically unharmed in a temperature where vegetable tanned leather would revert to a brittle, formless mass. It can be made exceptionally flexible. It has a high coefficient of friction. Consequently belting from chrome leather has found a place for itself, which would be larger, were it not for the deficiencies resultant from the lightness of the tannage, the lack of solidity of the leather and the necessarily high cost because of the small leather-yield. A leather tanned with a combination of alum and gambier, the gambier being used to supply the deficiencies of the alum as a filling material, has likewise had some vogue. It is tough and pliable, and has given good service for high-speed work.

TRUING THE GRINDING WHEEL

By Howard W. Dunbar

GRINDING machine operators are sometimes puzzled because of their inability to accomplish a desired finish in grinding a piece of work, when a very little care in truing the wheel would bring about the results sought for.

It is not always our object in truing a wheel to sharpen it, as is ofttimes the belief of the operator. Primarily, we true the wheel to produce a perfectly round and true cylinder, for no work can be ground more accurate than the wheel is. The slightest imperfections in the wheel in roundness or trueness of surface will produce imperfections in the work being ground. Secondly, we true the wheel to produce on the face of the wheel the proper condition to accomplish the results desired in the finish. Oftentimes, contrary to the general belief, we dull the particles in the face of the wheel because we desire a certain finish.

The Diamond Condition.

It is not true that the diamond must have a sharp corner, or a sharp edge, or a sharp point in order to be of service in

wheel truing. On the contrary, a diamond after having been used for a short time is a better agent for truing than a new diamond, due principally to the fact that the sharp corners, small projections, etc., have been worn from the diamond, and it maintains for a greater length of time the same area of exposed surface presented to the wheel when truing.

It can be readily seen that if a small point on the diamond was presented to the wheel for truing, this point would soon be worn away, and a true cylinder could not be the result, since the diamond is a greater distance from the centre of the wheel at the finish of the truing than it was at the beginning. It is true that this amount is very small, but, in precision grinding, we are dealing with tenths of thousandths of an inch, which means the utmost care and attention to the smallest details.

Speed of the Diamond

The speed with which the diamond is moved across the face of the wheel is also a controlling factor in the finish. If the diamond is brought across the wheel rapidly, it, to a certain degree, trues a thread on the face of the wheel, and although this is not visible to the eye, it works havoc with the finish of the parts being ground, since, with this thread across the face of the wheel on a diagonal line, mottles are produced in the work, which give the appearance of a frosted surface.

The diamond should travel slowly enough across the face of the wheel to be sure that all the particles have been brought to a given height, and are an equal distance from the centre of the wheel. To do this right, light traversing cuts with a diamond must be taken so as not to break up the surface of the wheel, but to gradually wear the particles down so that they all have this uniform height.

For roughing work the surface of the wheel should be broken up; the particles should be sharp, and necessarily do not need to be as accurate as when finishing. In this event the diamond is passed across the face of the wheel a little more rapidly, and taking a deeper cut. This is called "breaking up" the surface of the wheel.

Wheel Grain

It is commonly believed by many that the degree of finish possible with a wheel is governed entirely by the size of grain used, so that for a fine, highly reflecting surface it is necessary to use a very fine wheel. This is not true. A high reflecting surface can be accomplished with a coarse wheel which will be economical in removing metal, by simply truing the face of the wheel to a perfect cylinder, and with all the particles of uniform height. It can be readily seen by analyzing this that the grain has little or no effect upon the finish, as the particles come in contact with the work in rapid succession one after the other, and simply plow a path through the work being ground equal to their height.

With such a multiplicity of cutting tools as are carried by the grinding wheel, it is impossible to conceive of a condition where any of these particles would be so separated as not to produce a round, true cylinder with a good surface, even though the grains be large, if they are all of equal height. Even a polishing operation can be accomplished with a comparatively coarse, hard wheel, if in truing, the particles are dulled, the corners rounded, where not even a grinding mark can be noticed in the work.

It is also essential in truing that plenty of water be allowed to flow on the diamond. As the diamond is extremely hard and the particles in the wheel are hard, heat is generated, which causes the wheel and diamond to wear away rapidly: by allowing the water to flow upon the wheel while truing, this heat is carried away by the water or compound, which allows us to accomplish the truing with a greater degree of accuracy and perfection.

Rigidity of Diamond Fixture

Of course, it goes without saying that the diamond must be clamped rigidly in the diamond tool holder on the table of the machine. Any movement of the attachment will create irregularities in the wheel surface.

In addition to being clamped rigidly, a line passing through the centre of the diamond and tool holder should point below the centre of the wheel so that the diamond will come in contact with the wheel on a slight angle, say, approximately 5°, which allows the diamond to wipe across the face of the wheel instead of digging into it, and prevents any chattering which would surely result if the diamond pointed above the centre of the wheel.

This is a very important feature in truing the wheel face to a perfect surface, and when troubles from chatters, diamond marks or feed lines result, the first thing to do is to see if the diamond is tight in the holder, tight in its setting and wipes across the face of the wheel rather than digging into it.—Grits and Grinds.

"Huxley" has said, "Science is nothing but trained and organized Common Sense, differing from the latter only as a veteran may from the raw recruit, and the methods differing from those of common sense, only as the guardsman's cut and thrust differ from the manner in which a savage wields a club."

HIGH-SPEED STEEL

IN view of the apparent scarcity of this class of steel for tools, a circular has been issued from the British Minister of Munitions in order to classify the requirements of the industries of the country, to advise economy, and to investigate measures of husbanding the scrap material to the best advantage. A series of questions has been drawn up and answers are invited from the engineering and manufacturing firms who use high-speed steel. The questions are as follows:

1—What are your monthly requirements of high-speed steel?

2—Have you any difficulty in obtaining your regular supplies?

3—What unused stock of high-speed steel have you at present on hand?

4—What stock of partly used tools and ends of bars which could be used for making tips and for other purposes?

5—Do you keep all high-speed scrap separate, so that it may be returned to the steel makers?

6—What saving have you made or do you expect to make by the use of tools with the tips only made of high-speed steel?

The replies are to be addressed to Small Tool Department, Director General of Munitions Supply, Armament Buildings, Whitehall, S.W.

BRITISH PURCHASING OFFICIALS IGNORANT OF CANADA'S RESOURCES

THE High Commissioner of Canada, Sir George Perley, chairman, at a lunch of the Canadian Exporters' Club, on Dec. 16, spoke of the need of educational work lying before Canadian exporters in Great Britain. The High Commissioner's Office had found the Imperial Ministers of State as conversant with the resources of Canada as he was himself, but the purchasing officials who placed Government contracts were in a state of blank ignorance. Superior organization had enabled United States exporters to take more than a fair share of Imperial contracts. It was only at the last moment that he had secured the recent timber contract for British Columbia which Oregon lumbermen were on the point of getting.

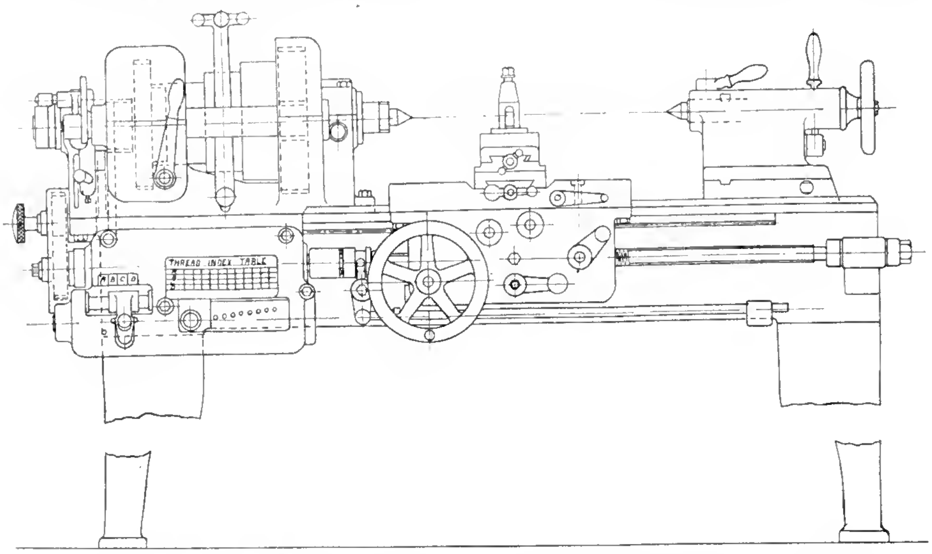
Secretary Armstrong, of the Canadian Exporters' Association, announced that the French had extended for Canada alone the date of entry at the Lyons Fair, which will take place next year instead of the Leipsic Fair, the period of grace given being a fortnight. Canadian entries will be received until January 15, and, thanks to the concession, Canada will have adequate representation.

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Machine, Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

14-IN. ENGINE LATHE

THE 14-in. engine lathe shown in the accompanying line drawing has been designed and placed on the market by the Canada Machinery Corporation, Galt, Ont., to meet the demand for a high-grade tool possessing the accuracy and capabilities of a tool-room lathe, along with the simplicity of operation and rigidity of construction necessary to enable it to meet all manufacturing demands.



14-IN. SWING ENGINE LATHE, WITH TWO-SPEED DOUBLE-GEAR DRIVE.

This lathe swings 14 in. clear, over the ways, and $8\frac{1}{2}$ in. over the carriage, the bed being of conventional design, and ample proportions.

Several features are incorporated in the headstock which for a tool of this size impart more than passing interest to the design. A three-step cone for $2\frac{1}{2}$-in. belt in combination with a two-speed double gear provides nine spindle speeds. A departure from orthodox practice is the placing of the double gearing on the front of the headstock. The eccentric handle for throwing out the gear has a plunger stop for "in" and "out" positions which avoids the annoyance of gears jumping out when slacking off the chuck. The increased safety and convenience due to this location of gearing are perfectly obvious.

While the accessibility of the belt has been somewhat reduced, the provision of an efficient belt-shifting device more than overcomes this slight drawback.

A commendable feature of the headstock design is the type of feed reverse gear mechanism. The reverse locking handle is permanently attached to the screw and ample space for operation is provided which is in direct contrast to the majority of designs which require the use of a separate spanner wrench in such cramped quarters that use of the feed reverse gear is only resorted to when unavoidable.

A total of 44 feed changes in four groups of 11 feeds each is obtained through the gear box. The two controlling handles are arranged close to each other, enabling the operator to select the group and locate the required feed practically simultaneously. A compactly arranged quadrant has a specially designed device which provides for the cutting of coarse pitch threads, and enables special change gears to be introduced for odd threads.

The lead screw is splined so as to act as feed shaft when plain turning, the traverse motion of the carriage being obtained by rack and pinion.

The traversing handwheel is conveniently located at the left of the apron: the nut-clamp handle, feed reverse handle, and friction knobs for longitudinal and cross feeds being arranged with a view to the elimination of all uncertainty of action on the part of the operator.

A stop-rod which throws out a clutch on the lead shaft is fitted with adjustable stops for stopping the carriage feed at desired points.

The lathe as illustrated has a 5-ft. bed and takes 34 in. between centres, which are No. 4 Morse type.

The tailstock has a set-over adjustment on the base, and is clamped to the bed by eccentric and lever. Taper turning attachments are furnished when required.

Reverse is obtained by cross belt on countershaft, two 12-in. x $3\frac{1}{2}$-in. pulleys being provided running at 255 and 210 r.p.m.

Particular interest attaches to this lathe as owing to its general excellence in design and workmanship it was selected as the standard machine for lathe instruction at the Central Technical School, Toronto, the first contract calling for sixteen machines.

BIG VALVES FOR ELECTRIC POWER STATION

THE Nelson Valve Co. has recently completed a portion of their contract for supplying the valves which are to be used throughout the new station of the Philadelphia Electric Co., Philadelphia, Pa. Included in the installation will be valves of practically every kind, from the smallest brass gate and globe valves to huge 42-inch solid wedge steel gate valves, like that shown in the illustration. These enormous valves stand 14 feet high, and two of them weigh as much as an average size steam road roller. In all there are to be seven of these units.

When installed, they will be operated from central panels on the turbine operating floor, which is fifty feet above the condenser pit floor line. Operating conditions call for 80 pounds working pressure.

16-IN. MOTOR OPERATED SOLID WEDGE GATE VALVE.

The valves have a steel clutch for disengaging the motor, if it is desired to operate them by hand. The design is such , however , that hand operation drives the limit switch at all times, so that if the motor is thrown into opera-

42-IN. MOTOR OPERATED SOLID WEDGE GATE VALVE.

tion when the valve is partly open, the limit switch is in the proper position for starting the motor, and throws out the automatic circuit-breaker on the control panel at the proper closing point of the valve disc.

There is a lost motion device between the stem unit and the large operating gear for the purpose of giving a hammer blow effect to break the seat of the valve in the event of scale causing the wedge to adhere to the seat. The motor is designed, however, of ample torque to open the valve without this hammer blow effect.

The body, bonnet, yoke, cap and gland are of cast steel. Cast "monel" seat rings have been used in the body, and the bonnet has a "monel" pack-when-open bushing. The solid wedge is cast in one piece of "monel" metal, and the rolled "monel" stem is attached to the wedge by means of a flexible coupling. The stem unit is of manganese bronze.

One characteristic feature of the valves is the high condensing chamber and deep stuffing box. The condensing chamber being located between the stuffing box and the inside of the bonnet, is claimed to insure longer life of packing and safety in renewing packing.

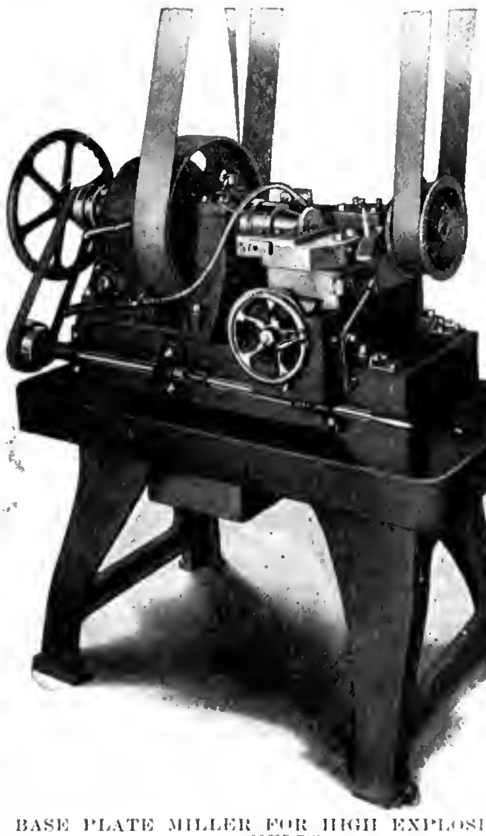
In addition to the 42-inch valves, seven 16-inch gate valves have been built and delivered. These valves are made for superheated steam of working pressure up to 250 pounds, and for a total temperature of 800 degrees F. Each valve has been tested to 800 pounds.

BASE PLATE MILLER FOR H. E. SHELLS

A NEW machine for milling base plates or plugs for high-explosive shells has been developed and is being built by Edwin J. Banfield, Toronto. This machine is designed for turning the outside diameter, finishing the face with the necessary camber and milling the threads, all at one chucking. It is of rigid and substantial construction and is driven direct from the line-shaft, no countershaft being necessary. The general design of the machine will be noted in the accompanying illustration.

On the bed, which is made of cast iron, there is mounted the headstock, and a saddle carrying the cross slide and tool holder. The headstock is movable and bolted to machined ways or slides, thus always keeping it in line when moving, being moved as is sometimes necessary if plugs of different thicknesses have to be machined. The headstock has a 3-in. hollow spindle with collet chuck and draw-back mechanism operated by a hand-wheel on the extreme left of the machine. A 16-in. x 4-in. pulley drives the spindle when machining the plug.

An important feature of the machine is a double jaw clutch mounted on the spindle and arranged so that in the first position it engages the main pulley with the spindle for machining the plug, and. in the second position, the spindle is re-



BASE PLATE MILLER FOR HIGH EXPLOSIVE SHELLS.

volved by a bronze worm and gear driven from an independent pulley at the back of the machine. The latter drive is used when milling the plug.

The fixture holding the tools and miller is mounted on a cross-slide on the saddle; the latter is movable and bolted to the bed. It is also adjustable so that any required camber can be obtained, the adjustment being made by means of four small set-screws. On the back of the cross-slide is fastened a bracket which carries a spindle holding the milling cutter, being driven by the pulley at the right-hand side of the machine. Extending from the bracket at the back is an arm carrying the chaser which engages with threads on outside of collet chuck. These threads have the same pitch as the threads on the plug, viz., fourteen per inch.

In operation, the square on the plug is gripped in the collet chuck. There are five tools in the tool post fixture which has the form of a right angle, and a roughing tool on the back section of cross-slide. This roughing tool turns the outside diameter and is brought into play by moving the cross-slide towards the operator. When this operation is completed, the cross-slide is moved back and the first tool roughs the face of the plug. This is followed immediately by a similar tool which finishes the face. The tool holder continues to travel forward and another tool faces the back of the plug for riveting purposes. This is followed by a tool which chamfers the corner.

The threads are milled at the next operation. The slide is moved back towards the operator until the milling cutter at the back is in position. A dog is slipped into position which ensures the chaser nut engaging with the threads on the outside of the collet chuck. The clutch on the main spindle is then thrown back, bringing the worm drive into gear and giving the spindle the slow motion necessary for milling the thread. As soon as the operation begins, the chaser moves along the collet chuck and regulates the travel of the milling cutter. When beginning the cut, the milling fixture is adjusted in position against a set-screw, and a hand lever is used to return the milling fixture to its original position at the end of the cut. The feed for the cross-slide for the initial operations is controlled by the horizontal shaft in front of the bed. A trip at the side throws the feed out at the end of the operation. The feed shaft is driven from a two-cone pulley on the main spindle. A tank is located under the bed for catching the cutting compound and a rotary pump driven from a worm gear at the back feeds the compound to the tools.

This machine is being used for turning and threading plugs for 18-pdr., 4.5-in., 60-pdr. and 6-in. high-explosive shells.

ELECTRIC AIR HEATER AND BLOWER

AN electric heat blower has been put on the market by the B. F. Sturtevant Co., of Galt, Ont., and Boston, Mass. This consists of a small motor-driven fan discharging air through heating coils placed in an aluminum casing. The forced circulation renders it possible to deliver a large volume of hot air in a short time. The apparatus is readily portable and can be used in the same way as electric cooking utensils in connection with any wiring system.

The set is made in five different sizes, and delivery of air is made at one, two or three temperatures, depending on the size. The fan outlet can be turned readily so as to discharge in any direction. The switch mounted on the base has different positions, and the temperature of the air delivered depends upon the position to which the switch is turned. Handle for carrying can be seen in illustration.

ELECTRIC AIR HEATER AND BLOWER.

This little heat blower is ideal for warming rooms in the fall or spring, or on a winter's morning to heat a chilly bath room, or bedroom after the windows have been closed. It is also used for drying hair, laundried articles, for blowing furnaces, and in the garage for heating and for melting ice off the car.

In industrial establishments the electric heat blower has a wide field of service, and may be used successfully for drying in dyeing and cleaning establishments, in photographic and blueprint rooms, in hair-dressing parlors, in rooms, boats or yachts for drying paint, in store windows for preventing frosted windows, in laboratories or doctors' offices. It is also used for heating larger rooms, small theatres, halls, schools, etc., which are only used occasionally.

SINGLE-SPINDLE SHELL BORING MACHINE

A MACHINE being used extensively for boring 6-in., 8-in., 10-in. and 12-in. shells when provided with an expansion boring bar, with outer support and cradle for holding the shells, is illustrated herewith. The drive to the spindle is by means of a large spur gear operated by a three-step cone, giving three speed changes varying approximately from 17 to 30 revolutions per minute. The work-table is fed along the bed by means of a rack and spiral gear, and it has three changes of geared feed, ranging from 0.010 to 0.050 inch per revolution of spindle; the maximum length of the feed is 32 inches. There is an automatic release to the feed, and the table can be operated by hand.

ELECTRIC AIR HEATER AND BLOWER.

The work table is 21 inches wide and 36 inches long over the working surface, and it is entirely surrounded by an oil channel. It has square locked bearings on the base, and side adjustment can be made by means of a taper shoe. The distance from the centre of the spindle to the top of the table is 8¼ inches. The spindle is 3½ inches in diameter; it has a broad driving slot and a thorough retaining bolt for holding the boring bars. The hole in the spindle is a No. 11 Brown & Sharpe taper. The equipment includes a pump with piping and attachments and a countershaft. This single spindle boring machine is a product of the Newton Machine Tool Works, Inc., Philadelphia, Pa.

SINGLE SPINDLE MACHINE FOR BORING 6 IN., 8 IN., 10 IN. AND 12 IN. SHELLS.

LOOSE PULLEY REPAIR

By L. P.

ONE of the most common minor worries of the engineer-in-charge in a factory is to get machine hands to pay attention to the lubricating of loose pulleys. Where a belt has often to run for an hour or two on the loose pulley, the bush soon gives trouble, even with careful attention.

In the works of which the writer has charge, a 100 h.p. suction gas engine and a 40 h.p. steam engine are both belted to the same line shaft, the steam engine belt is on the loose pulley for twelve hours a day. The pulley is 3 ft. 6 ins. diameter, 11 ins. face, 3 ins. bore, with a 10 in. double belt about 50 ft. long, and as the line shaft runs at 155 r.p.m., it is no wonder the pulley bush soon cuts out.

It is important that the belt be kept on the steam engine ready for a quick change over in case of emergency. After the bush of this pulley had cut out three times in three months, I had it bored out 1 in. larger than the shaft. It was then placed in position, and fitted with rollers made from ½ in. bright mild steel. These were left soft, and had no cage or separator. The collars which kept the pulley in position also kept the rollers in. This was done over twelve months ago. For a greater part of time the plant has worked seven days a week.

After such a gratifying result under such trying conditions, I have had no hesitation in serving other pulleys the same, and I shall not have any more pulleys fitted with bushes, the rollers being much cheaper in first cost, and should renewal be necessary this can be done in much less time than is the case with a bush, as it is unnecessary to take the pulley down.—Power User.

Total Crop Estimate of Three Provinces.—F. O. Fowler, secretary of the North-West Grain Dealers' Association, Winnipeg, Man., estimates the total crop of the three Prairie Provinces this year at 737,682,000 bushels, over 200,000,000 bushels greater than any previous crop. The estimate is divided as follows: Wheat, 307,230,000; oats, 389,000,000; barley, 39,202,000; flax, 2,250,000 bushels.

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THE SEASON'S GREETINGS

THE editors of Canadian Machinery extend to its subscribers and correspondents the season's greetings, and take increased pleasure in doing so on this occasion, because of the many accessions to the ranks of each during the past twelve months. Since the establishment of this journal a decade ago, no one year has contributed so largely to our subscription lists numerically and as regards personnel, as has this Year of Grace 1915, and while aware that the percentage of firms, officials and operatives available to us are now on our books, and look forward eagerly to each issue as it comes from the press, we anticipate in the coming time to have the list practically all-embracing.

Our Annual Review Number comes from the press on December 30, bigger and brighter than ever, and brimful of Canada's progress, development and achievement in a world-memorable year. On January 6, 1916, the first number of a new volume will make its appearance, and, although good resolutions are more generally associated with the opening days of a new year, the closing days of an old year are, we believe, more conducive to their ultimate realization. Advantage should therefore be taken now by those still beyond the scope of our medium to take time by the forelock and enrol themselves so as to start with our Annual Review Number.

BRITISH MACHINE TOOL IMPORTS UNDER CONTROL

NOT a little excitement was aroused among machine builders in the United States and even in Canada when it became known that Great Britain had decided to control the importation of the products of such concerns in future. As is usual in similar circumstances, a good deal more was read into the proclamation instituting the enactment than it actually contained or was intended to convey. For the benefit of our readers, many of whom have doubtless heard nothing of the matter so far, we reproduce the cabled advice of the proclamation as well as the essence of follow-up cables concerning it.

Under date, December 2, the United States Embassy in London, advised the Department of Commerce, Washington, D.C., that "A Royal Proclamation of November 30, 1915, prohibits, after December 21, the importation into the United Kingdom of all machine tools and parts thereof, except small tools. A further exception is made in favor of machine tools, and parts thereof, imported under the license of the Board of Trade, and subject to the provisions and conditions of such license."

Receipt of subsequent cables in response to inquiries instituted by firms on this side, and apparently affected, elicited the information that the Board of Trade license will be available to all British importing firms established at least two years before the outbreak of war and doing business to the extent of $50,000 annually. Further, the firms so licensed must limit their profits to 18½ per cent.

In view of the foregoing, there is not even the semblance of a ban on the importation of Canadian and American machine tools into Britain, the effect being rather and altogether to ensure not only the uninterrupted receipt of the products of reputable machine tool builders on this side, but the protection of the good name of the latter which is equally important. It will also tend to centralize purchases, a convenience of no small moment.

A recent statement of Lloyd-George, Britain's Minister of Munitions, places the number of controlled factories at two thousand, and, the workers involved, at one million. It appears strange, yes surprising, that even while the scheme of control was in the early stages of development, no steps were taken to also control the necessarily imported requirements of the plants affected.

In the more or less headlong rush to equip, the unscrupulous dealer of course butted in, and while the meantime urgency practically prohibited challenging of his exorbitant prices for tools, or the extravagant claims made for their fitness for the required duty, operative experience seems to have laid bare the situation, and demanded some such step being taken as that embodied in the proclamation, etc., already quoted.

We may say that complete unanimity of opinion as to the wisdom of the action taken exists among all reputable builders of machine tools, both in Canada and the United States.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey forge, Pittsburgh	$17 95	
Lake Superior, charcoal, Chicago	19 25	
Ferro nickel pig iron (Soo)	25 00	
	Montreal.	**Toronto.**
Middlesboro, No. 3	$24 00	....
Carron, special	25 00	....
Carron, soft	25 00	....
Cleveland, No. 3	24 00	....
Clarence, No. 3	24 50	....
Glengarnock	28 00	....
Summerlee, No. 1	30 00	....
Summerlee, No. 3	29 00	....
Michigan charcoal iron	28 00	....
Victoria, No. 1	24 00	24 00
Victoria, No. 2X	23 00	24 00
Victoria, No. 2 plain	23 00	24 00
Hamilton, No. 1	23 00	24 00
Hamilton, No. 2	23 00	24 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	2.75
Steel bars, f.o.b., Toronto	2.75
Common bar iron, f.o.b., Montreal	2.50
Steel bars, f.o.b., Montreal	2.75
Twisted reinforcing bars	2.55
Bessemer rails, heavy, at mill	1.25
Steel bars, Pittsburgh	...
Tank plates, Pittsburgh	...
Beams and angles, Pittsburgh	...
Steel hoops, Pittsburgh	
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.75
Small shapes	2.75
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	2.20
Structural shapes	2.30
Plates	2.30

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal	Toronto
Plates, ¼ to ½ in., 100 lb.	$2 75	$2 75
Heads, per 700 lb.	3 00	3 00
Tank plates, 3-16 in.	3 00	3 00

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$13 75	$13 75
Copper, crucible	16 25	16 25
Copper, unch-bled, heavy	15 75	15 75
Copper, wire, unch-bled	15 75	15 50
No. 1 machine compos'n	12 50	12 00
No. 1 compos'n turnings	11 00	10 00
No. 1 wrought iron	10 50	10 00
Heavy melting steel	9 50	9 50
No. 1 machin'y cast iron	13 50	13 00
New brass clippings	11 50	11 00
No. 1 brass turnings	9 50	9 00
Aluminum	32 00	29 00
Heavy lead	5 25	5 00
Tea lead	$ 4 25	$ 4 25
Scrap zinc	12 75	12 00

W. I. PIPE DISCOUNTS.

Following are Toronto jobbers' discounts on pipe in effect Dec. 14, 1915:

	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
Standard				
¼, ⅜ in.	60	36½	....	....
½ in.	65	45½	....	....
¾ to 1½ in.	70	50½	....	....
2 in	70	50½	66	46½
2½ to 4 in.	70	50½	69	49½
4½, 5, 6 in.	....	....	67	47½
7, 8, 10 in.	....	....	64	42½
X Strong P. E.				
¼, ⅜ in.	53	36½	....	....
½ in.	60	43½	....	....
¾ to 1½ in.	64	47½	....	....
2, 2½, 3 in.	65	48½	....	....
2 in.	....	....	60	43½
2½ to 4 in.	....	....	63	46½
5½, 5, 6 in.	....	....	63	46½
7, 8 in.	....	....	56	37½
XX Strong P. E.				
½ to 2 in.	41	24½	....	....
2½ to 6 in.	....	....	40	23½
7 to 8 in.	....	....	37	18½
Genuine Wrot Iron.				
⅜ in.	54	30½	....	....
½ in.	59	39½	....	....
¾ to 1½ in.	64	44½	....	....
2 in.	64	44½	60	40½
2½, 3 in.	64	44½	63	43½
3½, 4 in.	....	....	63	43½
4½, 5, 6 in.	....	....	60	40½
7, 8 in.	....	....	57	35½

Wrought Nipples.	
4 in. and under	75%
4½ in. and larger	70%
4 in. and under, running thread	55%
Standard Couplings.	
4 in. and under	57½%
4½ in. and larger	37½%

MILLED PRODUCTS.

Sq. & Hex Head Cap Screws	65 & 5%
Sq. Head Set Screws	70 & 5%
Rd. & Fil. Head Cap Screws	45%
Flat & But. Head Cap Screws	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in.	70%
Semi-Fin. Nuts up to 1 in.	70%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

METALS.

	Montreal.	Toronto.
Lake copper, carload	$22 00	$21 25
Electrolytic copper	21 75	21 00
Castings, copper	21 25	20 75
Tin	45 00	43 00
Spelter	21 00	19 00
Lead	6 85	7 00
Antimony	42 00	40 00
Aluminum	68 00	65 00

Prices per 100 lbs.

BILLETS.

	Per Gross Ton
Bessemer billets, Pittsburgh	$30 00
Open-hearth billets, Pittsburgh	31 00
Forging billets, Pittsburgh	52 00
Wire rods, Pittsburgh	40 00

NAILS AND SPIKES.

Standard steel wire nails, base	$2 80	$2 85
Cut nails	2 90	2 90
Miscellaneous wire nails	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	3 25	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	65 and 5
Stove bolts	82½
Plate washers	40
Machine bolts, ⅜ and less	60
Machine bolts, 7-16 and over	50
Blank bolts	50
Bolt ends	50
Machine screws, iron, brass	35
Nuts, square, all sizes	3¼c per lb. off
Nuts, hexagon, all sizes	3½c per lb. off
Iron rivets	67½
Boiler rivets, base, ¾-in. and larger	$3.75
Structural rivets, as above	3.75
Wood screws, flathead, bright	85, 10, 10 p.c. off
Wood screws, flathead, brass	67½ p.c. off
Wood screws, flathead, bronze	60 p.c. off

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Standard. Price. per ft.	Extra Strong. Sizes Ins.	Extra Strong. Price per ft.	D. Ex. Strong. Size Ins.	D. Ex. Strong. Price per ft.
⅛in	$.05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	....
7 in	2.38	7 in	3.81	....	....
8 in	2.50	8 in	4.34	....	....
8 in	2.88	9 in	4.90	....	....
9 in	3.45	10 in	5.48	....	....
10 in.	3.20	....	....	....	....
10 in.	3.50	....	....	....	....
10 in.	4.12	....	....	....	....

COKE AND COAL

Solvay Foundry Coke	$6.50
Connelsville Foundry Coke	5.95
Yough Steam Lump Coal	3.98
Penn. Steam Lump Coal	3.88
Best Slack	3.25

Net ton f.o.b. Toronto.

COLD DRAWN STEEL SHAFTING.

At mill	25%
At warehouse	20%

Discounts off new list. Warehouse price at Montreal and Toronto.

MISCELLANEOUS

Solder, half-and-half	0.23½
Putty, 100-lb. drums	2.70
Red dry lead, 100-lb. kegs, per cwt.	9.65
Glue, French medal, per lb.	0.15
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.25½
Benzine, single bbls., per gal.	0.25
Pure turpentine, single bbls.	0.87
Linseed oil, raw, single bbls.	0.87
Linseed oil, boiled, single bbls.	0.90
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.50
Lead Wool, per lb.	0.11
Pure Manila rope	0.16
Transmission rope, Manila	0.20
Drilling cables, Manila	0.17
Lard oil, per gal	0.73
Union thread cutting oil	0.60
Imperial quenching oil	0.35

POLISHING DRILL ROD

Discount off list, Montreal and Toronto 40%

PROOF COIL CHAIN.

¼ in.	$9.00
5-16 in.	5.90
⅜ in.	4.95
7-16 in.	4.55
½ in.	4.00
9-16 in.	4.20
⅝ in.	4.10
¾ in.	3.95
⅞ in.	3.80
1 inch	3.70

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	55
Carbon over 1½ in.	25
High Speed	
Blacksmith	55
Bit Stock	60 and 5
Centre drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Centre	25
Pipe Reamers	80

Discounts off standard list.

IRON PIPE FITTINGS.

Canadian malleable, A, 25 per cent.; B and C, 35 per cent.; cast iron, 60; standard bushings, 60 per cent.; headers, 60; flanged unions, 60; malleable bushings, 60; nipples, 75; malleable, lipped unions, 65.

TAPES

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3.50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$3 50	$3 50
Canada plates, dull, 52 sheets	3 25	3 25
Canada Plates, all bright	4 60	4 75
Apollo brand, 10¾ oz. galvanized	5 50	5 50
Queen's Head, 28 B.W.G.	6 00	6 00
Fleur-de-Lis, 28 B. W. G.	5 75	5 75
Gorbal's Best, No. 28	6 10	6 10
Viking metal, No. 28	5 25	5 25
Colborne Crown, No. 28	5 70	5 80
Premier No. 28	5 40	5 50
Premier, 10¾ oz.	....	5 75

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$14 25	....
1¼ in.	15 00	....
1½ in.	15 00	....
1¾ in.	15 00	....
2 in.	15 00	10 00
2¼ in.	16 50	11 00
2½ in.	17 50	12 85
3 in.	25 00	13 20
3½ in.	28 00	16 25
4 in.	33 00	20 75

Prices per 100 feet, Montreal and Toronto.

WASTE.

WHITE.	Cents per lb.
XXX Extra	0 12½
X Grand	0 11¾
XLCR	0 11
X Empire	0 10¼
X Press	0 09½
COLORED.	
Lion	0 08¼
Standard	0 07½
Popular	0 06¾
Keen	0 06
WOOL PACKING.	
Arrow	0 20
Axle	0 14
Anvil	0 10
Anchor	0 08
WASHED WIPERS.	
Select White	0 08½
Mixed Colored	0 06¼
Dark Colored	0 05¼

This list subject to trade discount for quantity.

BELTING RUBBER

Standard	50%
Best grades	30%

BELTING—NO. 1 OAK TANNED.

Extra heavy, single and d'ble,	40 & 10%
Standard	50%
Cut leather lacing, No. 1	$1.25
Leather in sides	1.10

ELECTRIC WELD COIL CHAIN B.B.

⅛ in.	$12.75
3-16 in.	8.85
¼ in.	6.15
5-16 in.	4.90
⅜ in.	4.05
7-16 in.	3.85
½ in.	3.75
⅝ in.	3.60
¾ in.	3.60

Prices per 100 lbs.

PLATING CHEMICALS

Acid, boracic	$ .15
Acid, hydrochloric	.05
Acid, hydrofluoric	.06
Acid, nitric	.10
Acid, sulphuric	.05
Ammonia, aqua	.08
Ammonium carbonate	.15
Ammonium chloride	.11
Ammonium hydrosulphuret	.35
Ammonium sulphate	.07
Arsenic, white	.10
Copper sulphate	.10
Cobalt sulphate	.50
Iron perchloride	.20
Lead acetate	.16
Nickel ammonium sulphate	.10
Nickel carbonate	.50
Nickel sulphate	.15
Potassium carbonate	.40
Potassium sulphide (substitute)	.20
Silver chloride (per oz.)	.65
Silver nitrate (per oz.)	.45
Sodium bisulphite	.10
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.35
Sodium hydrate	.04
Sodium hyposulphite (per 100 lbs.)	3.00
Sodium phosphate	.14
Tin chloride	.45
Zinc chloride	.20
Zinc sulphate	.07

Prices Per Lb. Unless Otherwise Stated.

ANODES

Nickel	.47 to .52
Cobalt	1.75 to 2.00
Copper	.22 to .25
Tin	.45 to .50
Silver	.55 to .60
Zinc	.22 to .25

Prices Per Lb.

PLATING SUPPLIES

Polishing wheels, felt	1.50 to 1.75
Polishing wheels, bullneck	.80
Emery in kegs	.4½ to .06
Pumice, ground	.05
Emery glue	.15 to .20
Tripoli composition	.04 to .06
Crocus composition	.04 to .06
Emery composition	.05 to .07
Rouge, silver	.25 to .50
Rouge, nickel and brass	.15 to .25

Prices Per Lb.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents

Montreal, Que., Dec. 20, 1915.—The closing days of the year 1915 find the commercial and industrial situation in a very satisfactory condition. The returns for export trade during the months of November and December will probably exceed those of any previous period in the history of the Dominion. The successful handling of a record grain crop has been one of the chief factors in the general business improvement.

Consumers of steel, whose needs are apparently urgent, are paying premiums of from $2 upwards per ton for early delivery of material. The pressure upon the steel producers, nevertheless, continues so great, that the placing of orders for early future shipment is almost impossible. With the probability, however, of no immediate action being taken as regards the manufacture of heavy guns in Canada, the market, before the spring, may show some indications of relief from the present strain.

Pig Iron

Even with the furnaces well filled up for the first quarter of the coming year and in many cases longer, inquiries for pig iron are still coming in. Local dealers report some little stir, but generally speaking, the market is quiet with quotations holding firm.

Steel

No relaxation is evident in the pressure lately prevailing in all lines of steel products. The mills are filled with orders so far in advance that listed quotations can only be taken as approximate. Buyers who wish delivery at an early period, may obtain same on payment of heavy premiums, but even this method is not always successful. While the mills are not taking on orders for specified delivery, they are endeavoring to arrange a schedule whereby the needs of their customers will be satisfactorily filled, without showing preference to anyone in particular.

Added to the inability of the producers to supply the demand, the shortage of cars is causing some inconvenience, delivery of coal to the mills being often delayed. Inquiries for billets, of late, have quieted down a little, owing likely to consumers being pretty well covered. Delay in placing further orders for shells is apparently having its effect upon this class of steel. The trade in bars, plates, and shapes, while quiet at present, shows some indications of early activity. Local prices remain unchanged.

Machine Tools and Supplies

Trade conditions throughout the machine tool industry continue active, and while the pressure along certain lines appears as great as a few weeks ago, there is a possibility that the opening months of the new year may find the intensified strain of the past half year somewhat relaxed.

Present indications point to the improbability of Canada partaking in the manufacture of heavy field guns, as the authorities believe that the delay in producing the required supply would be excessive. However, as many plants are rapidly being equipped for the production of the larger types of shells, the machine tool builders are kept busy supplying their requirements. Future necessities may yet call for the production of heavy ordnance.

CANADIAN GOVERNMENT PURCHASING COMMISSION

The following gentlemen constitute the Commission appointed to make all purchases under the Dominion $100,000,000 war appropriation:—George F. Galt, Winnipeg; Hormidas Laporte, Montreal; A. E. Kemp, Toronto. Thomas Hilliard is secretary, and the commission headquarters are at Ottawa.

The improvement in the domestic demand for machine tools is quite noticeable, but the prospect of increased activity is hampered owing to delayed deliveries.

Inquiries for supplies continue to come in, and quotations on some lines have stiffened. High-speed steel and twist drills are in such demand that definite quotations are next to impossible.

Metals

The general condition of the various metals may be reported satisfactory. Copper, during the week has shown a slight advance, while tin is firm, but dull. Reports of the early closing of the Suez Canal will likely affect the delivery of future supplies. Lead has shown an advance after considerable dullness, but aluminum is on the decline.

Copper.—The market this week is stronger than of late, with dealers reporting brisk business. A firmer tone has been cabled from the London market, which has had its effect here. With the increased demand, quotations show an advance of $10 per ton. Lake copper is now quoted at $22 per hundred, and electrolytic is 21¾c per pound, while castings show an increase of ¼c per pound, being listed at 21¼c.

Tin.—The anticipated closing of the Suez Canal in the near future is expected to have some effect on this metal, as deliveries will be somewhat delayed, due to the longer sea passage. Local dealers report business quiet, but prices unchanged, at 45c per pound.

Spelter.—The situation shows little change from the previous week, and although inquiries are constantly coming in, local dealers are not being crowded. Foreign dealers report activity with advancing prices, but here there is no change. The market is firm at 21c per pound.

Lead.—This has been featureless for some time the demand appearing to be falling off. However, while dullness seems to prevail, the present prices show an advance of 1-10 cent per pound. This week's quotation is 6.85c per 100 pounds.

Antimony.—With plenty of antimony in sight for current consumption, the market is holding steady at last week's price of 42 cents per pound.

Aluminum.—The tension shown in this metal during the past few weeks seems to have reached its high-water mark, present prices being somewhat easier than a week ago. A decline of 2c per pound leaves the present price at 68 cents.

Old Material.—Business in the scrap metals during the past week has somewhat improved, and certain lines are showing strength. Considerable trading has been reported among dealers, and although many of the large mills are well covered for the coming quarter, they nevertheless are open to receive further supplies. No. 1 machine composition has been quite active during the past week and is stronger at our advance of $10 per ton. No. 1 wrought has also advanced, and is quoted this week at $10.50. Aluminum scrap is still in great demand and dealers are offering at the present time 32c per pound.

Toronto, Ont., Dec. 23.—There is little change of importance to note in the general industrial situation. Factories engaged upon war orders are busy, and the outlook in this respect continues favorable. The placing of these orders is now being done on a more systematic basis and as a result more business is coming to Canada. The complete trade returns for November have been made public by the Minister of Customs. The statement shows an increase of nearly 100 per cent. in domestic exports for November over the figures for the corresponding month last year.

The value of exports totals $92,000,000 made up in part of manufactured goods valued at $13,000,000, and minerals at

$6,500,000. The shell industry continues to create considerable interest and preparations for making the large calibre shells are being pushed ahead. The credit of $50,000,000 which the Dominion Government has established for financing war orders will meet, to a considerable extent, the financial requirements of the Imperial Munitions Board for some months to come. In order to facilitate the placing of additional shell contracts, the Hon. W. T. White, Minister of Finance, has suggested that Canadian manufacturers of munitions should accept as part payment, British exchequer bonds.

The steel market continues very firm, and prices have an upward tendency. A new list has been issued for wrought iron pipe, and iron bars have also advanced. New prices for cotton waste have been issued and another advance is expected in the near future. The machine tool business continues active and there is a better demand for lathes for the large shells. In the ingot metal market, copper and spelter have advanced and tin is developing greater strength. Lead, antimony and aluminum are unchanged.

Steel Market

The situation in the steel market continues much the same, the mills are operating at capacity and prices are holding very firm, with an advance on iron bars. Steel bars advanced to 2.75c recently and now iron bars are quoted at the same figure. With the mills employed principally on producing steel for munitions, deliveries on merchant bars are becoming more backward. Prices of wrought iron pipe have advanced. The new list went into effect on Dec. 14th. Prices of boiler plates and tubes are expected to advance early next year, but those on Pittsburgh bars, plates and shapes for this market are still withdrawn.

There is no improvement in the galvanized sheet situation, the market being demoralized with the continued advance in raw materials. Quotations are extremely irregular; some mills have withdrawn from the market while others are quoting on the basis of the cost of spelter. Prices in the selected quotations are pretty close to the market, but are liable to advance any time. The market for black sheets is very strong and prices have an upward tendency. No. 28 black sheets are quoted at 2.50c to 2.75c, and blue annealed 2.50c, Pittsburgh.

No new developments have to be noted in the American market. The mills are sold up for from four to six months and much of the business now being placed is for delivery at convenience of the mill. The export demand for finished iron and steel continues heavy but a railroad blockade in the East is holding up shipments and causing considerable delay and inconvenience. No important advances have been made during the week, it being the general opinion that values are quite high enough. The market, however, is very strong and the quotation of 1.70c, Pittsburgh, on bars, plates and shapes has become almost nominal. Prices of billets are unchanged, but are expected to advance as the scarcity is becoming more acute.

Pig Iron

Sales of Lake Superior ore have been very heavy at 75c advance over the 1915 quotations. The pig iron market is very strong and prices are very firm. Lake Superior charcoal iron has advanced to $19.25 per ton; other quotations are unchanged. "Hamilton" and "Victoria" brands are quoted at $24 per ton.

ALLIES PURCHASING AGENTS

The Trade and Commerce Department, Ottawa, has published the following list of purchasing agents for military purposes for the allied Governments:

International Purchasing Commission, India House, Kingsway, London, Eng.

French.—Hudson Bay Co., 56 McGill Street, Montreal; Captain Lafoulloux, Hotel Brevort, New York; Direction de l'Intendence Ministere de la Guerre, Bordeaux, France; M. De la Chaume, 28 Broadway, Westminster, London.

Russian.—Messrs. S. Ruperti and Alexsieff, care Military Attache, Russian Embassy, Washington, D.C.

Coal and Coke

The coal and coke market is very strong, and prices have advanced on most grades. A big demand and shortage of labor has stiffened the market which may advance again in the near future. The new prices are given in the current market quotations.

Old Materials

The market for old materials is much firmer and improved business is reported. Steel melters are taking large tonnages of heavy melting steel, and prices are very firm. Scrap copper is also in good demand and quotations are slightly higher. Prices of other metals are unchanged.

Machine Tools

An important development in the machine tool market has been the publication of a proclamation in London prohibiting the importation into the United Kingdom of all machine tools and parts thereof, except small tools. An exception is made in favor of machine tools being imported under a Board of Trade license. The best opinion seems to be that the proclamation does not aim to cut off imports of machine tools, but to centralize purchases in the future and eliminate small dealers and speculators, thus protecting the market against inferior tools. The machine tool requirements in Great Britain are to a large extent satisfied, which should indirectly relieve the situation in Canada as regards deliveries. Locally, dealers report no change in the situation, and are actively employed figuring on equipment for machining the large-calibre shells. Suitable second-hand tools have become scarce and prices are higher.

Supplies

An advance in cotton and wool waste has been announced; the new list is given in the selected market quotations. Manufacturers advise that another advance will be made early in January. The increasing cost of raw materials has obliged the manufacturers to take this action. New and higher prices for bolts and nuts have been issued.

Metals

A slight advance in both copper and spelter are the two most important features to note this week. The copper market has been strong for some time and higher prices were expected. The spelter market is probably being manipulated. The Suez Canal scare has cropped up again, but there appears to be a probability that the canal will be closed for military reasons. In this event steamship routes will have to be adjusted and steamers will be obliged to use the Cape of Good Hope route. This arrangement will no doubt affect tin market on account of the delay involved to cargoes. The delay will not, however, be serious, as good stocks are available. The lead, antimony and aluminum markets are quiet and unchanged.

Copper.—The market is very strong, and is said to be controlled by the large producers. It is reported that the demand is as insistent as at any time during the last six weeks. The markets in London and New York are strong and higher. The local market has advanced ½c and Lake Copper is now quoted at 21¼c per pound.

Tin.—The London market is higher and prices are entirely nominal. There appears to be a possibility of the Suez Canal being closed, in which case shipments of tin would have to come round by the Cape. The delay entailed to shipments enroute would not necessarily be very serious, as available stocks are sufficient for immediate requirements. The market, however, may be affected temporarily and may go higher. Local

quotations are unchanged at 43c per pound.

Spelter.—The market is again unsettled and is apparently being manipulated. It is thought that there is a move on foot to depress prices. Local quotations are higher and nominal at 19c per pound.

Lead.—The London and New York markets are quiet and unchanged. The "Trust" price is 5.40c New York. Local quotations are unchanged at 7c per pound.

Antimony.—Recent arrivals of antimony in New York have caused the market to become easier. Business is quiet and quotations unchanged at 40c per pound.

Aluminum.—The market is easier but supplies continue to be scarce. Local quotations are unchanged at 60c per pound.

HIGHLY SATISFACTORY TRADE STATEMENT

WHAT is in many respects the most satisfactory statement of Canadian trade ever issued was made public on Dec. 16 by the Minister of Customs, Hon. J. S. Reid. The statement shows an increase of nearly 100 per cent. in domestic exports for November, as compared with the figures for November, 1914. The total under this head was $92,000,000. the imports for the month amounting in value to a little under half this sum, or $45,000,000.

The exports of $92,000,000 are made up principally of agricultural products, $54.000,000; manufactured goods, $13,000,000; animals and meats, $12,000,000; minerals, $6,500,000; lumber, etc., $4,500,000, and fisheries, $2,000,000. All these show a very substantial increase over the corresponding month for 1914. agricultural products jumping from $18,000,000 to $54,000,000. manufactured goods from $6,000,000 to $13,000,000, and animals, etc., from $8,000,000 to $12,000,000. The export of minerals is also exactly double that of November, 1914.

The feature of the imports totalling $45,000,000, is the large increase in the value of free goods imported during November last, these totalling $19,000,000. as against $12,000,000 for November, 1914. The total trade of Canada for November just ended, was $154,000,000, as against $126,000,000 for November, 1914.

For the eight months of the present fiscal year, Canadian trade totalled $863,000,000, as against $766,000,000 for the corresponding eight months of 1914.

Imports for the eight months of the present year were $298,000,000, a decrease of $20,000,000 for the corresponding period of 1914.

The domestic exports for the eight months of the present fiscal year were $419,000,000, as against $269,000,000 for the same period last year.

CANADIAN COMMERCIAL INTELLIGENCE SERVICE

The Department of Trade and Commerce invites correspondence from Canadian exporters or importers upon all trade matters. Canadian Trade Commissioners and Commercial Agents should be kept supplied with catalogues, price lists, discount rates, etc., and the names and addresses of trade representatives by Canadian exporters. Catalogues should state whether prices are at factory point, f.o.b. at port of shipment, or, which is preferable, c.i.f. at foreign port.

Ottawa. R. Grigg, Commissioner of Commerce.

CANADIAN TRADE COMMISSIONERS.

Argentine Republic.
H. R. Poussette, Reconquista, No. 46, Buenos Aires. Cable address, Canadian.

Australasia.
D. H. Ross, Stock Exchange Building, Melbourne, Cable address, Canadian.

British West Indies.
E. H. S. Flood, Bridgetown, Barbadoes, agent also for the Bermudas and British Guiana. Cable address, Canadian.

China.
J. W. Ross, 13 Nanking Road, Shanghai. Cable address, Canecoma.

Cuba.
Acting Trade Commissioner, Lonja del Comercio, Apartado 1290, Havana. Cable address, Cantraecm.

France.
Phillipe Roy, Commissioner General, 17 and 19 Boulevard les Capucines, Paris. Cable address, Stadacona.

Japan.
G. B. Johnson, P.O. Box 109, Yokohama. Cable address, Canadian.

Holland.
Acting Trade Commissioner Zuidblaak, 26, Rotterdam. Cable address, Watermill.

Newfoundland.
W. B. Nicholson, Bank of Montreal Building, Water Street, St. John's. Cable address, Canadian.

New Zealand.
W. A. Beddoe, Union Buildings, Customs Street, Auckland. Cable address, Canadian.

South Africa.
W. J. Egan, Norwich Union Buildings, Cape Town. Cable address, Cantracom.

United Kingdom.
E. de B. Arnaud, Sun Building, Clare Street, Bristol. Cable address, Canadian.
J. E. Ray, Central House, Birmingham. Cable address, Canadian.
Acting Trade Commissioner, North British Building, East Parade, Leeds. Cable address, Canadian.
F. A. C. Bickerdike, Canada Chambers, 36 Spring Gardens, Manchester. Cable address, Cantracom.
J. Forsythe Smith, Fruit Trade Commissioner, Canada Chambers, 36 Spring Gardens, Manchester.
J. T. Lithgow, 87 Union Street, Glasgow, Scotland. Cable address, Contracom.
Harrison Watson, 73 Basinghall Street, London, E.C., England. Cable address, Sleighing, London.

SPECIAL TRADE COMMISSIONER—LUMBER.

H. R. McMillan, visiting Europe, Africa, Australasia and the Orient.

CANADIAN COMMERCIAL AGENTS.

British West Indies.
Edgar Tripp, Port of Spain, Trinidad. Cable address, Canadian.
R. H. Curry, Nassau, Bahamas.

Norway and Denmark.
C. E. Sontum, Grubbeged No. 4, Christiana, Norway. Cable address, Sontums.

South Africa.
D. M. McKibbin, Room 34, Permanent Buildings, Harrison Street, Johannesburg.
E. J. Wilkinson, Durban, P.O. Box 673, Durban, Natal.

CANADIAN HIGH COMMISSIONER'S OFFICE.

United Kingdom.
W. L. Griffith, Secretary, 17 Victoria Street, London, S.W., England. Cable address, Dominion, London.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Hamilton, Ont.—The Tallman Brass Co. are building an addition to their plant.

Quebec, Que.—The Shawinigan Electric Power Co. will build a transformer station here.

Woodstock, Ont.—William Baird will build an addition to his machine shop on Dundas Street.

Vancouver, B.C.—The C. P. R. propose installing a 50-ton electric crane on their wharf here.

Welland, Ont.—The Canada Forge Co. will build an addition to their forging plant at a cost of $25,000.

Montreal, Que.—A large extension will be made to the local plant of the Steel Company of Canada. The cost will be approximately $24,000.

Dartmouth, N.S.—The Williston Steel & Foundry Co., of Halifax, will build a steel plant here at a cost of about $16,000.

Chatham, Ont.—It is authoritatively reported that the Imperial Oil Company intends building a refinery in Western Canada, supplied by a pipe line from Wyoming fields.

Transcona, Man. — The Transcona Shell Co. are installing special machinery in the railway shops here for making munitions. Sir Herbert Holt, of Montreal, is interested in the company.

London, Ont.—An addition, costing $40,000, will be made to the London Gas Engine Co. plant here. Some time ago the buildings and machinery were disposed of by W. H. Braddon to W. H. Heard, of the Spramotor Co.

Halifax, N.S.—The Halifax Tramway Co. will make large extensions to their power installation, costing about $500,000. The additions include a complete gas plant having a capacity of 600,000 cubic feet, with provision for further enlargement. A new machine shop will also be built. 146 ft. by 150 ft.

Hamilton, Ont.—The Canadian Cartridge Co. have purchased a four-acre site, and will immediately begin work on the construction of a large addition to their factory. The extension will include a brass foundry and a plant for rolling brass sheets. Blanks for cartridge cases will also be made. The company, of which F. W. Baillie is manager, plans to spend over $250,000 on the new

Municipal

Guelph, Ont.—The hydro-radial bylaw will be submitted to the ratepayers on January 3.

Hull, Que.—The city council are contemplating extensions to the lighting system, estimated to cost $20,000.

CANADIAN PURCHASES FOR FRENCH WAR OFFICE

Philippe Roy, General Commissioner for Canada, Paris, advises the Department of Trade and Commerce, Ottawa, that an order has been issued by the War Department of the French Government to the effect that all purchases made by the Supply Branch in Canada will pass through the Hudson Bay Co. Canadian producers should therefore submit their future offers through the office of that company at Montreal. It is further stated in Mr. Roy's communication that Canadian lumber, steel and meat will find in France an important market for years to come, but it is necessary that Canadian firms should have in Paris representatives entrusted with the necessary authority, especially if it is desired to secure Government contracts.

Port Elgin, Ont.—The Village Council will submit a by-law to authorize the installation of a hydro-electric system.

Cobden, Ont.—The ratepayers vote on a by-law on Dec. 27 to raise $20,000 for the construction of a plant for the generation and distribution of power.

Melfort, Sask.—The town is considering the purchase of a 240-h.p. Diesel oil engine for its power house at a cost of $17,000.

Hamilton, Ont.—Chief Ten Eyck has submitted plans and specifications for a new motor truck for the fire department. Tenders will be called later.

Unionville, Ont.—The town council contemplate improvements to the waterworks system to cost about $12,000. E. A. James of Toronto is the consulting engineer.

Tweed, Ont.—The town council contemplate the construction of a waterworks system at an estimated cost of $25,000. Kerry and Chaee, Ltd., Toronto, are the engineers.

Glace Bay, N.S.—Plans are being prepared for the installation of a pumping unit, estimated to cost between $5,000 and $10,000. A. McKinnon is town engineer.

St. Thomas, Ont.—The Village of West Lorne voted last Monday on the introduction of hydro for lighting and power. The by-law was carried by a majority of 100.

Alliston, Ont.—A by-law will be voted on by the ratepayers on Jan. 4 to sanction certain privileges to the Alliston Electric Light Co., to erect transmission lines for lighting purposes.

Toronto, Ont.—The Board of Control have requested the Hydro-Electric Commission to enter into negotiations for the purchase of the Metropolitan division of the Toronto & York Radial Railway Co.

Cornwall, Ont.—A by-law will be voted on by the ratepayers on Jan. 3 to raise the sum of $25,000 for the purpose of erecting an addition to the pumping station and installing additional machinery.

Warwick, Que.—The Town Council are considering the construction of a light and power system at an approximate cost of $10,000, and are negotiating with the Arthabasca Water & Power Co. for a supply of power.

Listowel, Ont.—A by-law will be submitted to the ratepayers on January 3rd to authorize the loan of $12,000 to a company for the erection of a boot and shoe factory. The company consists of H. B. Morphy, F. W. Hay, A. H. Hawkins and J. S. McGee, all of Listowel.

General Industrial

St. Catharines, Ont.—A chemical works is being established here to manufacture potash.

Hamilton, Ont.—Negotiations are now under way with a company who propose establishing a factory here.

Fergus, Ont.—A by-law to loan the Superior Barn Equipment Co. $10,000 for the establishment of a factory will be submitted to the ratepayers.

Montreal, Que.—The premises of the Boston Blacking Co., 23 Cabot street, Cote St. Paul, was destroyed by fire on Dec. 11, the damage being estimated at $5,000. Spontaneous combustion is believed to have been the cause.

Kincardine, Ont.—A by-law to grant tax exemption for a period of ten years to the Ontario People's Salt & Soda Co. will be submitted at the January elections. The company propose making additions to their plant, estimated to cost $10,000.

St. Catharines, Ont.—A new factory is to be started in St. Catharines with potash as its output. The company, which is known as Chemical Refinery, Ltd., will manufacture potash from refuse, which will be used as a cheap land fertilizer. Construction work has already been started. A by-law to grant partial exemption will be voted upon by the ratepayers in January.

Personal

David Arthur Law, superintendent of the Waterworks Department, Prince Albert, Sask., died in Winnipeg, Man., on Dec. 9, aged 46.

Colonel David Carnegie, of the Imperial Munitions Board, has left for New York, whence he sails to spend six weeks or two months in England.

Frank E. Watkins, formerly associated with the Canadian Fairbanks-Morse Co., Ltd., Toronto, Ont., has been made works manager of the East Jersey Pipe Corporation, Paterson, N.J.

T. R. Deacon, president of the Manitoba Bridge & Iron Works, Winnipeg, and **J. G. Sullivan**, chief engineer of the C. P. R. Western Lines, were present at the breaking through of the heading of the five-mile tunnel under Rodgers Pass on December 13.

General Alex. Bertram, deputy chairman of the Imperial Munitions Board, has left Ottawa for the South for a vacation. General Bertram is feeling the effects of the prolonged strain of his work since the Shell Committee, of which he was head, was created, and has taken his first vacation since that time.

William A. Conner, vice-president of the Standard Underground Cable Co. of Canada, Ltd., Hamilton, Ont., died Dec. 6. The deceased, who was a resident of Plainfield, N.J., has been a director of the above company for the past ten years and first vice-president since 1909. He planned and constructed the Hamilton works.

Trade Gossip

The Dominion Chain Co. have increased their capital stock to $500,000.

The Canadian Car & Foundry Co., Montreal, has recently secured a contract from the Union Government of South Africa for two steel, underframe flat cars.

Windsor, Ont.—Machinery is being installed in the new Windsor Ice & Coal Co. building, at McDougall and Shepherd streets, and the place will be ready for occupancy by February 1. It will be used as a cold storage plant. The cost of the building, with machinery, is estimated at $30,000.

Lachine Canal Tonnage.—Final figures regarding the Lachine Canal navigation season show that 41,352,876 bushels of grain were brought down this year, as against 67,343,952 bushels in 1914, a decrease of 26,991,076 bushels. The total number of vessels which used the canal was 590, as against 615 last year, but their total combined tonnage this year amounted to 249,050, an increase of 19,795 tons.

Ford Motor Co. Increases Capital.—The stockholders of the Ford Motor Co., Ltd., of Canada, at a meeting held at Ford, Ont., on Dec. 14, ratified the increasing of the capital of the company from $1,000,000 to $10,000,000 and the distribution of 100 per cent. dividend. The Canadian Ford Co. was incorporated in 1904 with $125,000 capital. The charter was under the laws of the Province of Ontario. This charter was afterwards cancelled and a charter obtained under the laws of the Dominion of Canada, with a capital of $1,000,000. The stockholders at the time received a stock dividend of eight to one.

N. S. Engineers Meet.—The ninth annual meeting of the N. S. Society of Engineers held at Halifax, N.S., recently, elected the following officers: President, J. L. Allan; first vice-president, W. S. Ayers; second vice-president, A. J. Barnes; secretary-treasurer, D. McD. Campbell. Councils: Halifax, Guysboro, and Hants, J. W. Roland and P. A. Freeman; Cape Breton, G. D. McDougall, C. M. Odell; Antigonish, Pictou, Colchester and Cumberland, R. E. Chambers, A. J. Robb; Kings, Annapolis, Digby, Yarmouth, Shelburne, Lunenburg and Queens, James McGregor, F. H. Sexton. Auditors: J. H. Winfield, L. H. Weaton.

Rogers Pass Tunnel.—The final charge was exploded on December 19 in the heart of Mount Macdonald, opening a passage between the east and west headings in the C. P. R. tunnel now being drilled through this mountain. The ceremony was performed two and a half miles from either exit, six thousand feet below the surface. The construction of Rogers Pass Tunnel is the greatest engineering feat of the kind on the continent. The tunnel when completed late in 1916 will be 26,400 feet long, and with approaches an additional nine miles. The width is 29 feet and height 21. There is a double-track. It saves an elevation of 552 feet, reduces the track length 4.3 miles, eliminates 2,400 degrees of curvature and four and a half miles of snowsheds. The maximum grade in the tunnel is $95.100.

Tenders

St. Hyacinthe, Que.—Tenders will be received up to January 11 for a mechanical filter plant. Plans and specifications may be obtained at the office of Hector Cadieux, city engineer.

Winnipeg, Man.—Tenders will be received up to Monday, December 27, 1915, for the supply on one saddle tank locomotive to the Greater Winnipeg Water Commission. Specifications and form of tender may be obtained and contract may be inspected at the offices of the district, 901 Boyd Building, Winnipeg, Man.

Halifax, N. S.—Tenders will be received by the Governor of the Province of Macao, up to till January 8, 1916, for the supply of a steel, self-propelling dredge for the use of the Macao Harbor Works. Full particulars may be obtained at the office of Fred H. Oxley, Consul for Portugal, Keith Bldg., Halifax, N.S.

Winnipeg, Man.—Tenders, addressed to the undersigned, will be received up to Wednesday, Dec. 29, 1915, for the supply of one steam operated dragline excavator. Specifications and form of tender may be obtained at the office of the Greater Winnipeg Water District, S. H. Reynolds, Chairman of Commissioners, 901 Boyd Building, Winnipeg.

Winnipeg, Man. — Tenders addressed to the undersigned will be received up to Wednesday, December 29, 1915, for the supply of twenty twenty-yard automatic air-dump cars. Specifications and form of tender may be obtained and form of contract may be inspected at the office of the district, S. H. Reynolds, Chairman of the Greater Winnipeg Water Commissioners, 901 Boyd Building, Winnipeg, Man.

Annual Review Number

Retrospect and Prospect

"Ring Out the Old, Ring in the New,
Ring Out the False, Ring in the True,
The Year is Dying, Let It Go."

INDUSTRIAL prosperity has been a marked feature of the past year, and although unavoidably of a grim type, its immediate effect has been such as to place Canadian business and commercial enterprises on a pedestal of achievement hitherto considered beyond their grasp. The manufacture of munitions of war has demonstrated our readiness to cope with an emergency, as well as our resourcefulness, ingenuity and operative skill. Our metal-working plant capacities have been increased twofold, and, what is perhaps of greater importance, we have been enabled to break away from our traditional conservatism as regards manufacturing a greater variety product and catering to wider scope markets. Shell making on its own account and the activity developed in the machine tool and steel industries have so overshadowed everything else in volume and value output that on this occasion their combination feature rightly claims first consideration.

Shell Manufacture

In our 1914 Annual Review Number a brief descriptive article appeared relative to shrapnel shells, their manufacture in Canada having been then little more than started, although the experimental stage had been satisfactorily passed by most of the metal-working plants undertaking the work. We chose at that time as a title for the article: "The Manufacture of Shells, an Impromptu Canadian Industry," but those of us who have been in close touch with machine tool and machine shop activities during the past twelve months will frankly admit that the impromptu feature has disappeared and that munitions production has for a long period, is now and may continue to be for several months one of our staple industries.

On that occasion we indicated that contracts for the manufacture of shells in Canada would be distributed by a specially-appointed Shell Committee, and laid special emphasis on the fact that in placing contracts, arranging for the finished and semi-finished parts, collecting, assembling and inspecting these in detail and as the completed shell, the difficulties to be encountered and the work involved were such as the man in the street was quite unable to appreciate. Many seemingly insurmountable obstacles were met and successfully overcome, with the result that for over a year now shell production has been creditably achieved in Canada over a wide area and through the medium of metal-working plants, widely diverse in capacity and as regards peace-time commodity.

Shell Committee Achievement

By the engineering skill, expert knowledge and untiring energy and disinterested activities of Brig.-Gen. Bertram, Hon. Col. Thomas Cantley, and Hon. Col. David Carnegie, we have not only placed ourselves in a more favorable position to compete successfully in the world markets against older-established manufacturing countries, but have, in addition, given substantial and effective aid to our Empire in its hour of trial. Detractors of the work of the Shell Committee, as was to be expected, have neither been few, nor sparing in their criticism. Justification of the committee's work is, however, superfluous in view of the results achieved and the widespread benefits derived by our citizens generally.

The abnormal industrial activity arising from shell manufacture has of necessity affected more or less every other forms of enterprise, some, of course, adversely, for the time being at least. Taken as a whole, however, and not losing sight of our record Western crop, it goes without saying that our lot has been far above the average during the year 1915, and that those—either individuals, communities, manufacturers, builders, transportation and public utility corporations, who have not yet participated in the prosperity enjoyed by their confreres, have every reason to anticipate its early opportunity.

RESOURCES CONSERVATION NECESSARY

The Canadian people would be wise to take advantage of this spell of prosperity not to indulge in extravagance, nor to launch out into new schemes of development which are not absolutely necessary or immediately reproductive, but to conserve their resources in every way possible. The British people are being hard pressed. The burden of taxation is huge. They will have to economize in every way possible. The help that is of the utmost value to them is the help the Dominions can give by, if possible, extending their credit. The power of the Dominion to do that is directly determined by the productive energy and economy of its own citizens.—Hon. R. H. Brand.

Railroads—Steam and Electric

As might naturally be expected, railroad extension, development and betterment have been much halted and curtailed during the year. The double circumstance of the pronounced business depression and the poor Western crop of 1914 were in themselves sufficient as deterrents to even a moderate degree of enterprise by either steam or electric railroad corporations. Attention has been devoted for the most part to upkeep of equipment and permanent way, and to the improvement of terminal facilities. The three most outstanding features in the year's activities of our three principal railroads are those of the equipment and opening of the Grand Trunk Pacific drydock and ship-repairing plant at Prince Rupert, B.C., the railroads Western terminal; the successful piercing of the Rogers Pass Tunnel, on Mount MacDonald, by the C.P.R.; and the progress towards completion of the tunnel through Mount Royal, Montreal, by the C.N.R. Regarding the

Rogers Pass Tunnel in the Rockies, facts of interest are those that the tunnel will be double-tracked, and 26,400 ft. long; that an elevation of 552 ft. and a track length of 4.3 miles are saved, while 2,400 degrees of curvature and 4½ miles of snow sheds are eliminated. The tunnel is expected to be wholly complete late in 1916.

Skilled Labor Scarcity

Due to recruiting for Canada's Overseas Contingents, skilled labor for munitions and general work shows an abnormal scarcity. The "Mechanics Wanted" columns of the daily and other press mediums continue to bear ample evidence of the acuteness of the situation, the requirements being for men experienced in the operation of machine tools for the most part. Several hundred of our mechanics have gone to Great Britain on contract for munitions work, but the measure of success of such a proceeding is not too clearly evident. Certain it is that by far the largest percentage of the men who have gone from our shores for the above purpose would have done equally well, if not better, in numerous munitions factories in Eastern Canada. Besides, the Empire aid would have been equally effective, and perhaps a great deal more so. A pleasing feature of the labor situation during the year has been the absence of strikes, and, therefore, the absence of bitterness between employer and employee.

New Union Station, Toronto

After many promises to proceed with this undertaking, and a prodigality of rumors as to dates on which the project would really be negotiated in earnest, the interested parties have at last taken definite action, and, although in the nature of things, having regard to the varied considerations entering into the project, and particularly those arising from the effects of the war in the matter of financial requirements, progress may be slow and effort somewhat curtailed, continuous work on the structure will be maintained to completion. While the need is great for a new Union Station in our Queen City, there are other directions in which the need is still greater, and which may not yield place to any other.

Financial

Our banks, like our manufacturers and our farmers, have had a good year, and, being interdependent, it could hardly have been otherwise. Individual, community, and national expenditures have for the most part been judiciously curtailed, the result being that the savings of our people have increased at an abnormal, although commendable, rate on bank deposit account, and in consequence have been withheld from speculative and other equally uncertain risks. In the development of the shell industry, our banks have borne their share, and arrangements are now in progress, we understand, to still further appropriate their aid.

Our Crop Records

This being referred to incidentally in a number of other sections of our review, it is only necessary to add here that, in addition to the provision of increased acreage on the part of our farmers, Providence was not only kind, but magnanimous. The 1915 crop has put prosperity in the West equivalent to that we are enjoying in the East, and it goes without saying that soberly, determined disposition of the revenue accruing from the earth's yield, will be the rule rather than the exception, as was the case in big crop years not over remote. Manufacturing in the East is sure to benefit greatly from the success of Western farming in 1915.

Gun Making in Canada

In the fall of the present year inquiry was made and investigation undertaken with a view to determining the suitability and adaptability of Canadian metal-working plants to the manufacture of ordnance to British Government specifications. A representative committee was appointed and in addition two experts in the persons of Sir Frederick Donaldson and General Mahan from the British War Office made a tour of inspection of our engineering establishments which in equipment and resources met most nearly the special requirements. Hopes were entertained that even on a small scale the manufacture of ordnance would be added to the list of our industries, but intimation received after the presentation of the expert report indicated that while we no doubt could successfully overcome the initial difficulties and make satisfactory headway in production, the time that must necessarily elapse before the latter was reached would most probably make our effort of questionable value during the present war.

In a sense it is perhaps just as well that the ordnance making proposition is meantime dropped, for being a highly skilled enterprise and much limited in its scope, neither the number of employees nor the wide circulation of money arising from orders placed compare in the least with the like considerations in shell manufacture. We have mastered the shell business, and its influence in every respect is broad and comprehensive; if we get all that is available, which we have a right to expect, then both the British Government and we ourselves will profit more than if we had gone into ordnance making as well.

New Welland Ship Canal

Work on this undertaking is proceeding satisfactorily, the importance of its completion within the anticipated time, because of the transportation advantages to be realized, nullifying as far as possible any restriction of expenditure that the war might tend to create. Unlike its big brother, the projected Georgian Bay Ship Canal, the Welland Canal is a proven utility, and will continue to enhance its reputation as such with the development of each succeeding year's Canadian agricultural and manufacturing enterprise. As regards the proposed Georgian Bay Canal, we are inclined to think that the war has made it more of a dream than ever before. In any case, at least a decade will pass before its sponsors evidence further activity on its behalf.

Port and Harbor Development

Port, harbor and waterway development, although not prosecuted on the like extensive scale to which we have been accustomed in recent years, has not wholly been halted. The Department of Marine and Fisheries and the various harbor commissions at our principal lake and ocean ports have applied themselves during the year to not only the maintenance of facilities already installed, but to their improvement in many directions, and to their addition in a host of others. Port records in some instances are not likely to make as good a showing for 1915 as for some immediately preceding seasons of navigation, due entirely to the disorganization of steamship services through the requisitioning of so many vessels from the fleets of leading shipping corporations, for trooping and hospital purposes, etc.

1915 Season of Navigation

The 1915 season of navigation now closed on Canada's inland waters has been, taken as a whole, generally satisfactory. The transfer of many lake craft early in and during the year to ocean service did much to offset the lean and opening months in so far as revenue production was concerned, and the successful transportation of a record percentage of a record crop in the period from September 1 to late in December, removed all doubt as to the revenue assuming substantial proportions.

On our lakes and rivers during 1915 there has been a pleasing absence of disaster and tragedy, casualties being for the most part light relative to both men and ships. Stormy, and recently quite wintry weather has prevailed on numerous occasions, but, thanks largely to beforehand advice being transmitted to the various ports and signal stations by the Weather Bureau, the necessary steps were taken by vesselmen to remain in or procure shelter.

The year 1915 in a world sense, however, has borne on its bosom a weight of marine tragedies and disasters. Storm

and tempest in their wildest and angriest moods, or in their most comprehensive operation scope have but a mean record to their credit compared to that established by man's ingenuity and artifices in the prosecution of this world war. On sea as well as on land a myriad masterpieces of man's brain and brawn have been destroyed and annihilated, and, no less true is it, that of men themselves—brave and unflinching, thousands have found a watery grave in one section or another of the Seven Seas.

Canadian Shipbuilding

A feature of the past year has been the transfer of many of our lake craft to ocean and ocean coasting service, this having become necessary because of the scarcity of "bottoms" in these spheres, the regular traders being employed for the most part on military and naval transport work for the Imperial Government. On a previous occasion we hinted at the possibility of many of our lake craft remaining at sea indefinitely. On aeount of the remunerative freight rates, and in view of the fact that transports and merchant vessels as well as battleships, in totals almost shocking, rest on oceans' bottoms, there will be numerous orders that even boom years in shipbuilding will find hard to fill, at least as promptly as will be the need. Again, many of our lake vessels will undoubtedly find the old Atlantic quite too strenuous, especially in its angry winter moods. Some of the craft have already succumbed, and in the nature of things, no matter how optimistic one may be and how high may be our opinions of the staunchness and fitness of our lake freighters for ocean service, it is quite inevitable that several more will be called upon to yield to the elements.

In years past, both recent and fairly remote, we have gone to the British Isles for our lake carriers—those of "canal size" particularly. Our vessel stock is becoming quite noticeably depleted, and, as stated above, is sure to maintain the tendency in that direction. We will, therefore, wake up to the fact, probably when it is too late, that Canada's trade and commerce has so developed, and is being so neglected, that she needs more ships. Under such circumstances, turning to Great Britain to build for us will be out of the question, for her own merchant marine will be in process of replenishing and will, of course, get first call.

Shipbuilding in Canada needs fostering; it has always needed it, although little was forthcoming. Canada needs merchant ships—lake, coastwise and ocean types—and by grasping the opportunity to place orders for their vessel requirements now, our shipping corporations would be directly helping themselves and incidentally establishing the shipbuilding industry of this Dominion on a sound and prosperous basis.

Iron, Steel and Metals

Iron, steel and metals during the year are dealt with at considerable length in other sections of this issue; it is, therefore, unnecessary to do more than refer to them here briefly. The abnormal demand for steel—finished and semi-finished—has drawn attention to the national importance of the industry, both as a supplier of our myriad domestic needs and as a factor in the development of a much to be desired export trade, and the most gratifying feature of the situation is to be found in the responsible appreciation being displayed and the earnestness of effort being put forth to consummate the above-mentioned dual achievement.

Technical Education

In matters educational, and more specifically that bearing in the technical direction, there falls to be recorded the completion and opening for business of the New Central Technical School at Toronto. A very full illustrated description of the Institution appears in this issue, from which there will be gathered that from every viewpoint it occupies a place of first prominence among similar establishments the world over. Considerable impetus, as a result, has been given the movement towards technical training all through the Dominion, and particularly in the larger industrial centres. Great things are of course looked for from this magnificent and up-to-the-minute school, and if these materialize, we may expect to find the scope of technical education in Canada increasing by leaps and bounds with each unfolding year.

New Quebec Bridge

Notwithstanding the general business upset due to the war and the widespread organization of our factories for munitions manufacture, work has proceeded at a most satisfactory pace on the erection of the new Quebec bridge. The illustrations accompanying the article appearing in another section of this issue indicate very clearly the progress made during 1915, and more particularly so if comparison be made between pictures of the structure when operations ceased for the winter of 1914, and the present one. In spite of the stupendous nature of the task, both in the shop and in the field, the builders are meeting every problem and contingency successfully, and we anticipate that when we chronicle progress made at the end of 1916, the achievement will be such as to warrant still further appreciation of the work of Canadian engineers.

Power Development

The past year, so far as the establishment of power generating plants is concerned, has been a lean one, a circumstance almost wholly traceable to the European War. Progress in the development and perfecting of new equipment has in consequence also been less marked. The demand for munitions of war from our factories has had but an indirect influence in stimulating business in power plant machinery and supplies, although the latter feature may in many lines be said to be well ahead of normal or peace times.

The urgency of the call for munitions has, however, been reflected in a very real sense upon all and every size and type of power installation. For months now, many of our industrial organizations, in order to meet the demand for shells and other war supplies, have been operating with practically no intermission, and with the latter of the briefest possible period in any case. Such a circumstance, and the fact of its having been made possible, indicates that, whatever else we may have lacked in the initial stages when transforming our workshops into arsenals, our power resources and equipment carried a generous margin. Renewals, replacements, and additions must necessarily be an early future expectation due to the strain which all power plant apparatus is undergoing.

There is little doubt that manufacturers of power plant equipment and accessories, whether of steam or hydro-electric type, have not altogether been idle in designing and developing new and improved units. They have appreciated the fact that with the new manufacturing vision and spirit dominating the activities of our plant administrators, there will be a casting about in search of the latest and most efficient power equipment with which to lower production costs and thus meet more effectually competition. The stagnation period in the realm of power equipment and specialties has lingered longer than those akin and accessory to it, yet the bottom "touching," is now quite an event of the past, and every evidence is forthcoming that the new year will witness considerable activity in every sphere of power generation and application.

Municipal and Building

This has been more than ordinarily a lean year so far as municipal enterprise is concerned, the primary cause being of course the impossibility of borrowing the necessary capital to finance projected improvements. Building and general construction work has also been largely at a standstill for financial reasons, and while, perhaps, only something less than the annual average must be reckoned for dwellings and residences generally, a rather heavy decrease falls to be noted relative to public buildings and other large institutions. It is anticipated, how-

ever, that the opening of the coming spring will give a fillip, both to municipal and general building construction work, and there is little doubt that the New Year 1916, will easily shame its predecessor in progressive accomplishment.

Machine Tool Industry

Other than the steel mills, machine tool manufacturing plants easily take pride of place as regards activity during 1915. Canada's machine tool industry has always been embodied in the personnel of but a few firms, and while these have largely met the needs of our manufacturing plants generally, their activities for the most part stopped there. The manufacture of shells has changed things somewhat in the latter respect, so much so that we find our machine tool builders shipping products of their own design and construction to Great Britain and elsewhere, and even letting-out their manufacture abroad upon a royalty basis.

Machine tool building has been wonderfully stimulated everywhere as a result of the war, and nowhere is this more patent than here in Canada. A new departure relative to machine tool products has been the accession to the ranks of previously established builders of their confreres in other metal-working industries, the particular specialty to which the new effort is directed being the manufacture of single-purpose machines for shell making. Large numbers of these products are under construction and in service, and while the munitions industry is with us, and the difficulty of getting delivery on standard or special general purpose tools remains unrelieved, such enterprise as has been displayed is commendable and highly appreciated by those having shell contracts to fill.

Peace—What Then?

Considerable speculation has been indulged in as to what the advent of peace will bring, whether business for a lengthened period thereafter will languish or whether normal if not boom times will succeed, as a result of the general endeavor to compensate for the lack of attention to our own more immediate domestic needs. It is freely hinted that our machine shops and metal working plants cannot fail then to find themselves weighted down with war-time purchased equipment, and that even with normal prosperity, the machine tool industry will go dead to stagnation.

We have travelled far these past fifteen months from a manufacturing standpoint, further than most of us have yet been able to fully appreciate. Most estimates of industrial conditions following the declaration of peace exclude this feature, and therefore, are based on those of pre-war times. As such they are of little value and but serve to indicate that those responsible for them are wholly unaware of Canada's up-to-date manufacturing achievement. The spirit behind our already-shown enterprise, although of war birth, will not evaporate or become numbed or extinct when the war ceases, but will give expression of increased vitality in directions and spheres whose scope will be immeasurably greater than even that now experienced.

Canada has struck a new stride in manufacturing, and the equipment to maintain it, she is only in process of accumulating. What will go to the scrap heap on conclusion of the war will have worthily served its immediate purpose, and its replacement will neither, we think, be irksome nor a hardship.

Taking Time By the Forelock

What steps are being taken by our manufacturers to set their houses in order, so to speak, to make easy the transition from war time commodity production to those of peace-time, we may not divulge, nor may we indicate just how widespread the movement in that direction. Certain it is that not all who ought are preparing for the sure eventuality of the war end. It may be that the disposition to hug profits realized and in process is so keen and strong as to obscure those perhaps which are equally procurable and possessed of a good deal more permanency at their source. However the attitude of each individual manufacturing concern, the time to plan, finance, and develop the domestic and foreign campaign is right now, for the reasons that munitions manufacturing has been shorn of its difficulties and terrors long ago, allowing opportunity for a new outlook; an enlarged, and in many cases a much enlarged plant will eat its head off by inactivity, and finally because the wherewithal to finance and establish a remunerative peace-time business has been earned as the past year's records of at least our large and more prominent manufacturing corporations clearly indicate.

We were not found wanting when the munitions opportunity presented itself; we may, if we will, however, be better prepared to tackle new opportunities when the munitions manufacture ceases.

NEW DEFENSE MEASURES

AN addition to the Defence of the Realm Act, gazetted on Dec. 23, prohibits the holding without special permission from the Minister of Munitions, of any exhibition which might affect prejudicially the production of war materials. There is also a general prohibition of the exhibition of war materials. A British industrial exhibition, which was to display war materials and the method of their manufacture, was in process of organization for 1916.

King George has formally approved the following five War Measures: Finance Act No. 3, relating to Government war obligations; Act No. 2, relating to trading with the enemy; Act relating to supplemental provisions of the war loan; Act forbidding an increase in rents and interest on mortgages; War Restriction Act.

INDUSTRIAL PROSPECTS BRIGHT IN HAMILTON, ONT.

INDUSTRIAL prospects in Hamilton are bright for the coming year. The Canadian Cartridge Co., which recently completed negotiations with the city, to erect a big plant, has now taken out a building permit. In addition to extensions at the plant of the Steel Company of Canada, which will aggregate in value nearly a million dollars, a number of new industries are in sight. The Eaton Company's big four-storey building on John Street, now nearing completion, will give employment to 300 people. Early in the new year the Canadian Horseshoe Company, the parent plant of which is in Erie, Pa., will be operating full blast. The Franklin Steel Works, of Joliet, Ill., is also completing its organization. Work will be begun shortly on a five-storey factory for the W. T. Rawleigh Company of Freeport, Ill., to manufacture toilet articles. The industrial department is in touch with a number of other firms, which are figuring on locating in Hamilton.

FINANCING SHELL CONTRACTS

THE \$50,000,000 credit established by the Government for the Imperial Treasury will meet, in substantial measure, the financial requirements of the Imperial Munitions Board for some months to come. It is not expected that there will be any difficulty with the lessening demands of the crop movement upon the Canadian financial system, in arranging for a further credit of \$50,000,000 or \$100,000,000 when required, through the subscriptions of those engaged in the manufacture of munitions for British Exchequer bonds, and by the system of dollar acceptances of the purchase by the banks of short date Imperial Treasury bills. As the Finance Act of 1914 will remain in force, facilities will be available in case of need for the rediscounting by the banks of any such securities or acceptances.

Halifax, N.S.—For the eleven months ending November 30, 1915, the value of building permits issued amounted to \$936,857, an increase of \$135,317 over the like period of 1914.

The Industrial Situation Viewed From Various Angles

Contributed and Selected

Being expressions of opinion from men prominent in the administration and management of iron, steel and allied enterprises regarding developments in trade, commerce, agriculture, manufacturing, etc., during 1915, and their bearing on the immediate and more remote future outlook relative to our Dominion. More or less optimism will be found predominant.

THE POWER TRANSMISSION MACHINERY VIEWPOINT

By C. F. Wheaton*

WITH respect to the industrial situation as it appears to us to-day, also as to the probable situation after peace is restored, are glad to say as follows:

As to the present concerning ourselves, we are certainly fully occupied in all departments and have been for past six months. For eighteen months prior to that, we were running about 60 per cent. of normal. Might state that, since our business is almost altogether done with manufacturers and power users generally, we have a fairly good opportunity of being in touch with the situation, and our observation is that probably 50 per cent. of the manufacturers of Ontario and Quebec are busy at the present time, either directly or indirectly, because of war orders, but for those not thus engaged, volume is still substantially below normal and will be, we believe, until peace has been declared.

After the War.—We cannot help but think that Canadian manufacturers generally are going to be very busy as soon as it becomes known that peace has been declared. We come to this conclusion because we know that as a general proposition stocks are very low throughout the country and, on the other hand, manufacturers generally have been "recovering," until to-day no doubt a large percentage of them are in a very much better position financially than they have been for years. All this must mean renewed confidence and a lot of new business.

*Managing Director, the Dodge Manufacturing Co., Toronto, Ont.

THE MINE AND MINERAL VIEWPOINT

By C. P. Hill*

OPTIMISM may be regarded as the keynote in business circles in the Western provinces, there being more enquiries for mining propositions in Vancouver than that city has ever known. This has naturally been brought about by the great demand for copper, lead and other minerals abounding in the province of British Columbia.

There is also a great revival in the coal industry, for the fact remains that the unrivalled crop in the Western provinces and the railways rushing out three times more cars than ever before, has given a splendid market for coal. It does not stop at this. The enhanced wealth of the West has given every man, woman and child from Winnipeg to the mountains a triple purchasing capacity, and they are exercising it all along the line.

There is also nothing short of a revolution taking place in the trading capacity of the country storekeeper. He allowed his shelves to become empty, and they remained empty until a good crop was assured. Every merchant in town and village then began buying on a very large scale to the mutual profit, of course, of the wholesaler and manufacturer in Montreal and other Eastern points.

The one weak spot in the West, but it is being forgotten very rapidly, was the farmer who took a hundred dollars a year or two ago and came into town and bought a lot, the value of which was increased by a real estate agent to ten thousand dollars. With this ten thousand dollars the farmer thought he was a rich man and settled down in the city, but he soon went broke and now he is taking up more land. As a wiser and poorer man he will not likely make the mistake a second time.

*Vice-President, Pacific Coast Mines, Ltd., Vancouver, B.C.

THE STOVE AND METAL WARE MANUFACTURING VIEWPOINT

By Margaret Wade.*

THE closing months of the year just completing marks the turning point from the depression which has been so marked a condition throughout Canada during the past two years.

The crisis was met by our manufacturers generally, with an optimism and confidence so splendid, and an adaptability to the enforced conditions so ready, that they admitted of no defeat, and latterly had needed only a comparatively slight impetus to start the volume of trade once more on the upward trend. That impetus came with the satisfactory crop of this autumn, since the harvesting of which business has shown a decided improvement. The future would seem to promise during the duration of the war, healthier home trade than we have had for some time, and, if we seize the occasion rightly a very much augmented export business.

We believe there is a danger, however, that in endeavoring to meet the urgency of the sudden demand upon us, through the cutting off of supplies from former sources, some of our manufacturers may be tempted to sacrifice something of quality to expeditiousness.

The policy of "quality first" is one which we owe to ourselves as a nation, and as individual manufacturers to follow, in order to develop through the opening created by present conditions an enlarged, sound and stable trade of the future, and that greater Canada to which our unprecedented opportunities and vast resources entitle us.

The close of the war will undoubtedly bring another disruption of trade conditions, but this should be only temporary, and when it will come, or the form it will take, are, of course, beyond present conjecture.

*Editor, McClary's "Wireless," London, Ont.

THE SAW AND PULPMILL MACHINERY VIEWPOINT

By C. H. Waterous*

THERE is probably no doubt but that the actual condition of business in Canada to-day is very much better than it was a year ago, and that the general feeling is also much more optimistic. The better crops, the great demand for men and for everything required by the armies in the field, have given employment to practically all who wish to work, and have made the distribution of money so much more widespread that considerable prosperity is a natural result.

In our business, which is the manufacturing of machinery for the production of lumber and pulp, the demand during the past year has been extremely light, and we were probably among the first to be affected by the cutting down of expenses in the way of building new mills and making additions.

While it was expected that the demand for paper would be increased on account of the war, this does not seem to have been the case, the sales of paper and pulp having been, we are informed by manufacturers, extremely slow, and judging by the demand for this class of

*Manager, the Waterous Engine Works, Brantford, Ont.

machinery, we can heartily endorse the position.

There probably would have been by this time a greater cleaning out of the stocks of lumber were it possible to sesure transportation facilities, particularly water borne, but the lack of shipping has made it, we are informed, practically impossible for the holders of lumber stocks to get to consumers abroad. The destruction in Europe would probably have made a large market for timber if the material could have been gotten there.

The splendid crops in the Northwest will no doubt make a demand for lumber on the prairies; this is now depleting and will continue to deplete the stocks in British Columbia, as well as of the mills in the prairie provinces themselves. We are, therefore, I think, justified in looking for an increased trade in our line of manufacture for the coming year.

BANK EXECUTIVE VIEWPOINT

By Sir F. Williams-Taylor.*

THERE is now a decidedly more hopeful feeling throughout the Dominion, and there is excellent ground for reassurance in the material advantages that have resulted from a bountiful harvest. When we consider that the North-West alone has produced several hundreds of millions of dollars' worth of agricultural products in the past year in an area where in the boyhood of the middle-aged not a sod was turned, we feel that this is a form of genuine pros perity to inspire confidence and in which our pride is pardonable.

When we begin to analyze other features of the situation there is, however, less room for satisfaction. The war in which the Empire is engaged to protect its integrity has made it incumbent upon Canada to assist the Mother Country in every way possible. We have already provided a large number of troops and more will follow. In the manufacture of munitions, clothing and other requisites, we are doing our full share. This has brought profitable employment to Canada when sorely needed, and at the same time rendered great service to the common cause. Let us, however, remember that the manufacture of war materials is a grim and transient form of so-called prosperity, that the cost thereof comes out of the national exchequer of Great Britain or of Canada, and from the blood of the flower of our manhood.

Also the United Kingdom has advanced large amounts to Canada for military expenditure, and the time may come when it will be desirable, if not necessary, for the Dominion to finance its own requirements. In any case, we must economize in every way possible so that we may bear our full measure of responsibility during the war and be prepared for the taxation that must follow.

Canada's greatest wealth lies at her feet, and her economic future is bound up in the development of vast agricultural areas of unsurpassed fertility. The rate at which that development can be accelerated is dependent upon the rate of increase in our farming population. Immigration can best be attracted to the Dominion by reducing and keeping down the cost of living, and that, in my opinion, is the key to the whole economic situation.

*General Manager, Bank of Montreal.

INVESTMENT BROKER'S VIEWPOINT

By W. Sanford Evans*

I AM impressed by the signs of fundamental improvement in the situation in Western Canada as the result of a recent trip through the West. This year's large crop has been moving out in unprecedented volume and at prices which represent a satisfactory profit on production. Cash wheat has been bringing from 10 cents to 20 cents per bushel more than did the crop of 1913. The railways between Winnipeg and Fort William have handled more freight cars in a day than any double track or single track lines ever did before.

The proceeds of the crop are going largely to the payment of debts, and one cannot talk with men in any line of business without realizing that the past few weeks have seen an exceptional liquidation. Money is accumulating in all the mortgage companies through repayments, and there is so far a relatively small demand for new loans.

Business generally is beginning to feel the effects of the improved conditions, and these effects must gradually extend to all legitimate lines. An exhibition is now being arranged in Winnipeg of the products of some fifteen or more new factories established since the war began. I believe the general attitude towards conditions to be sane and even conservative.

There is no trouble about the conclusion that it is sound to liquidate, but the problem will be what to do with the surpluses of cash and the reserves of credit, and also what to produce and what not to produce in 1916. It is therefore on these points it will be difficult to make wise decisions without clearly recognizing what is abnormal in present conditions and without remembering the lessons of the past three years.

*Chairman, Georgian Bay Canal Commission.

BANK EXECUTIVE VIEWPOINT

By H. V. Meredith.*

THE unprecedented conditions under which trade and commerce have been conducted during the past year remain unchanged, and are the cause of constant anxiety to those concerned with financial affairs. All things considered, however, the trade of Canada has been well maintained, both as to volume and character. Natural resources continue to be developed and their product to find a ready and profitable sale, while many branches of manufacture have been employed to capacity in turning out munitions of war, the money value of which runs into scores of millions. The resulting employment of labor has been of almost incalculable advantage.

The restoration of a favorable balance in our foreign trade is a factor of supreme importance at the present time, as it enables us to conserve our gold supplies and to curtail our borrowings abroad to some extent. War contracts, of course, have contributed substantially to this feature, the value of manufactures exported having risen from $39,000,000 in the first seven months of the last fiscal year to $84,000,000 in the same period of the present year, and, as in the case of cereals, this export trade is on an ascending scale.

The position of Canada is a highly favored one, with an assured future of growth, development and general prosperity. At present, however, we live in the shadow of the great war, to which all else must be subservient. What its duration will be, and the position in which its termination will find us, can be matter of the merest conjecture. The vast armies now engaged in the struggle cannot be kept in the field indefinitely. The financial factor is daily assuming increased importance, and in this respect the advantage is unquestionably with Great Britain and her Allies.

After the war, a readjustment of trade conditions is to be expected. The flood of wealth which has attended the export of munitions and war supplies must of necessity be largely curtailed, and a new set of problems will have to be faced. Our agricultural resources and undeveloped wealth will enable us to bear any strain which may be imposed upon us, and we shall in the end come safely through the period of economic upheaval and world-wide conflict—with a larger debt, it is true, but with our ability to meet it unquestioned and our economic position not seriously impaired. In the meantime, our duty as Canadians is to watch closely the current of events, and to be prepared for emergencies and to take advantage of propitious circumstances as they arise.

*President, Bank of Montreal.

MANUFACTURING looms large in the personal constitution of every community and nation: little wonder is it, then, that with the call for men as well as for munitions, the response of this Dominion was prompt and generous. The accompanying list embraces, as far as we have been able to procure, those representative Canadian manufacturers, members of their families and administrative staffs, who have heeded the call of Empire for active service in one or other of our overseas contingents.

Major Woodman Leonard, E. Leonard & Sons, London, Ont.

Captain E. E. Williams, Dunlop Tire & Rubber Goods Co., London, Ont.

Captain Clifford T. Trotter, Standard Clay Products, St. Johns, P.Q.

Captain Harold L. Trotter, H. Holgate & Co., engineers, Montreal, Que.

Captain Harvey B. Evel, Evel Casket Co., Hamilton, Ont.

Captain H. J. Heasley, Sadler & Haworth, Montreal, Que.

Captain W. D. Greer, Consumers Gas Co., Toronto, Ont.

Captain J. T. Duguid, Imperial Steel & Wire Co., Collingwood, Ont.

Captain F. F. M. Brown, College Press, Ltd., Toronto, Ont.

Captain C. R. Crowe, Crowe Iron Works, Guelph, Ont.

Captain Smith, E. D. Smith & Son, Winona, Ont.

Captain F. R. Newman, Canadian Fairbanks-Morse Co., Toronto, Ont.

Captain J. M. Eakins, Canada Grip Nut Co., Montreal, Que.

Captain F. P. Duck, D. Acland & Son, Winnipeg, Man.

Captain G. H. Weld, Farmers' Advocate, Ltd., Winnipeg, Man.

Captain W. L. Roblin, Winnipeg Telegram, Winnipeg, Man.

Captain R. Steacie, Smart-Woods, Ltd., Montreal. (Killed.)

Lieut. Garret, Steel and Radiation, Ltd., Toronto, Ont.

Captain George D. McLauchlan, McLauchlan & Sons Co., Owen Sound, Ont.

Captain H. C. Trenaman, Domestic Specialty Co., Hamilton, Ont.

Captain J. S. Grafton, Grafton & Co., Dundas, Ont.

Captain R. A. McAvity, T. McAvity & Sons, Ltd., St. John, N.B.

Captain Victor Nordheimer, The Nordheimer Piano & Music Co., Toronto, Ont.

Captain Alexander Campbell, Campbell Steel & Iron Works, Ottawa, Ont. (Died of illness.)

Captain Walter A. Harrison, T. H. Estabrook Co., St. John, N.B.

Captain Edgar H. Shuttleworth, J. R. Shuttleworth & Sons, London, Ont.

Captain A. R. Taylor, T. W. Taylor Co., Winnipeg, Man.

Lieut. Harvey Cockshutt, Cockshutt Plow Co., Brantford, Ont.

Lieut. C. H. Ackerman, B. F. Ackerman, Son & Co., Peterboro, Ont.

Lieut. K. E. Drinkwater, A. B. See Electric Elevator Co., of Canada, Ltd., Montreal, Que.

Lieut. T. E. Ryder, Canadian Fairbanks-Morse Co., St. John, N.B.

Lieut. J. V. Young, Hamilton Cotton Co., Hamilton, Ont.

Lieut. W. L. McIntosh, Canon Lake Lumber Co., Winnipeg, Man.

Lieut. W. S. Drewry, E. L. Drewry, Ltd., Winnipeg, Man.

Lieut. G. H. Saltmarsh, Metallic Roofing Co., Winnipeg, Man.

Lieut. Wm. Martin, Jr., Manitoba Gypsum Co., Winnipeg, Man.

Lieut. B. M. Green, Smart-Woods, Ltd., Montreal, Que.

Lieut. Jack Woods, Smart-Woods, Ltd., Montreal, Que.

Lieut. Lacey, Steel and Radiation, Ltd., Toronto, Ont.

Captain Trumbell Warren, Gutta Percha & Rubber Co., Toronto, Ont. (Killed.)

Lieut. P. D. McAvity, T. McAvity & Sons, Ltd., St. John, N.B.

Lieut. E. C. H. Moore, Coleman Baking Powder Co., Brockville, Ont.

Lieut. Ian Hendrie, Hamilton Bridge Works, Hamilton, Ont.

Lieut. Geo. C. Wright, E. T. Wright Co., Hamilton, Ont.

Col. Chas. Smart, Smart-Woods, Ltd., Montreal, Que.

Col. John Gunn, Gunns, Ltd., Montreal, Que.

Lieut.-Col. J. Bruce Payne, J. Bruce Payne, Ltd., Granby, P.Q.

Lieut.-Col. Wm. Hendrie, Hamilton Bridge Works Co., Hamilton, Ont.

Lieut.-Col. J. L. McAvity, T. McAvity & Sons, Ltd., St. John, N.B.

Lieut.-Col. R. W. Patterson, Winnipeg Paint & Glass Co., Winnipeg, Man.

Lieut.-Col. Frank Howard, Brantford Emery Wheel Co., Brantford, Ont.

Lieut.-Col. A. B. Petrie, Petrie Mfg. Co., Winnipeg, Man.

Lieut.-Col. G. F. C. Poussette, assistant secretary C.M.A., Winnipeg, Man.

Lieut.-Col. J. J. Carrick, Pigeon River Lumber Co., Port Arthur, Ont.

Lieut.-Col. J. A. Currie, M.P., Imperial Steel & Wire Co., Collingwood, Ont.

Lieut.-Col. F. C. McCordick, Frank C. McCordick, St. Catharines, Ont.

Lieut.-Col. E. W. Rathbun, The Rathbun Co., Deseronto, Ont.

Lieut.-Col. A. J. Oliver, R. McDougall Co., Galt, Ont.

Lieut.-Col. J. F. L. Embury, Canadian Lock Joint Pipe Co., Regina, Sask.

Lieut.-Col. F. B. Black, J. L. Black & Sons, Ltd., Sackville, N.B.

Lieut.-Col. Ibbotson Leonard, E. Leonard & Sons, London, Ont.

Major F. J. Dingwall, D. R. Dingwall, Ltd., Winnipeg, Man.

Major W. R. Marshall, Standard Fuel Co., Toronto, Ont.

Major John McPhee, Barrie Tanning Co., Barrie, Ont.

Major Wm. Scully, Wm. Scully, Montreal, Que.

Major Kimmins, E. D. Smith & Son, Ltd., Winona, Ont. (Killed.)

Major T. McAvity, T. McAvity & Sons, Ltd., St. John, N.B.

Major Pelly, Steel & Radiation, Ltd., Toronto, Ont.

Major Russell Britton, manager Cowan & Britton, Ltd., Gananoque, Ont.

Major W. R. Turnbull, Robert Duncan & Co., Hamilton, Ont.

Major J. K. Bertram, The John Bertram & Sons, Co., Dundas, Ont.

Major J. R. L. Parsons, Canadian Lock Joint Pipe Co., Regina, Sask.

Major T. C. Irving, Moffat-Irving Co., Toronto, Ont.

Major P. R. Hanson, Dunlop Tire & Rubber Goods Co., Montreal, Que.

Major C. J. Whittier, Somerville & Co., Brandon, Man.

Lieut. W. H. McLaren, McLaren's, Ltd., Hamilton, Ont.

Lieut. H. C. Hatch, Canada Steel Goods Co., Hamilton, Ont.

Lieut. R. G. Hutchinson, International Harvester Co., of Canada, Ltd., Calgary, Alta.

Lieut. Donald S. Fisher, Enterprise Foundry Co., Sackville, N.B.

Sergeant W. A. Logie, Smart-Woods, Ltd., Winnipeg Man.

Sergeant Harold Rolph, Rolph & Clark, Ltd., Toronto, Ont.

Corporal A. R. Ackerman, B. F. Ackerman, Son & Co., Peterboro, Ont.

Corporal Stewart L. Young, Young-Thomas Soap Co., Regina, Sask.

Pte. Murton Rugg, E. W. Rugg Co., Winnipeg, Man.

Arthur H. Coles, Edmonton Law Stationers, Ltd., Edmonton, Alta.

Pte. A. C. Bertram, The John Bertram & Sons Co., Dundas, Ont.

Pte. Norman V. Cliff, Toronto Salt Works, Toronto, Ont.

Pte. Alex. G. Rosamond, Rosamond Woolen Co., Almonte, Ont.

Pte. Warren Nelson, Semi-Ready, Ltd., Montreal, Que.

Capt. H. R. Cleveland, president J. L. Goodhue & Co., left Canada with the Fifth Canadian Mounted Rifles, but has since been transferred to the brigade staff under Brig.-Gen. C. A. Smart, Second Brigade, Canadian Mounted Rifles.

Capt. J. M. McIntosh, secretary, Toronto Branch Canadian Manufacturers' Association, has left for Brandon, where he has been appointed Adjutant of the 79th Battalion.

Obituary Record of Business and Public Men

The year now closing has taken toll of a rather over-average percentage of business and public men who at one time or another figured more or less prominently in the upbuilding of our Dominion. It is due them and their work that the event of their passing be here recorded.

Horatio F. Forrest, a well known civil engineer, died in Winnipeg on January 19, in his 73rd year.

William Snider, vice-president of the Waterloo Mfg. Co., Waterloo, Ont., died on March 8, aged 68.

James F. Markey, master mechanic in Toronto for the G. T. R., died suddenly in Toronto, on April 23.

Walter Stuart, of Lucknow, Ont., owner of the electric light plant and planing mill, died on Feb. 18.

Captain John McMulkin, died on Feb. 24, aged 79 years. He was New Brunswick's first factory inspector.

Robert Bowie, vice-president of the Canada Foundries & Forgings, died at Brockville, Ont., on August 13.

John Knox, treasurer of the Dominion Power & Transmission Co., died at his home, Hamilton, Ont., on Aug. 31.

Giles S. Ranson, president of the Toronto Furnace & Crematory Co., died in Toronto on Aug. 31, at the age of sixty-two.

John Oliver Parker, head of the J. O. Parker & Co., brass works, died on Feb. 27, at his residence, Toronto, aged 67 years.

Osgood McVean, senior member of the firm of O. & W. McVean, wheel manufacturers of Dresden, Ont., died there on Feb. 26.

Capt. P. M. Campbell, director of the Collingwood Shipbuilding Co., died at Collingwood, Ont., on Sept. 10, at the age of 69.

John S. Anthes, one of the oldest and best known furniture manufacturers in Ontario, died at Berlin, Ont., on April 13 in his 71st year.

Charles Stewart, one of the senior partners of Burrow, Stewart & Milne, founders, died at his home in Hamilton, Ont., on Oct. 8, at the age of 78.

Captain Murdock McLean, a well-known marine captain, died at Duluth on March 4, of heart trouble. Captain McLean was born in Kincardine 60 years ago.

Capt. Murray Wilson, manager of the cordite department of the Canadian Explosives Co., was killed on July 6, by an explosive at the plant at Beloeil, Quebec.

William H. Rowley, president of the E. B. Eddy Co., Ottawa, Ont., died suddenly in Toronto on Jan. 12. Mr. Rowley was born in Yarmouth, N.S., on March 25, 1851.

Walter D. Beardmore, head of the firm of Beardmore & Co., passed away in Toronto on May 23. Mr. Beardmore, who was in his 66th year, was born in Hamilton, Ont.

John A. Culverwell, hydraulic and electrical engineer, who for some years was connected with power development in the Trent Valley district, died in Toronto on April 21, aged 48 years.

John Cowan, president of the Ontario Malleable Iron Co., Oshawa, Ont., died at his home in Oshawa, on April 8, aged 86. Mr. Cowan was born in Tyrone, Ireland, and came to Canada in 1841.

Joseph R. Henderson, of Montreal, president and general manager of Brandram-Henderson, Montreal and Halifax, manufacturers of paints, etc., died suddenly in Halifax, N.S., on July 31.

Frederick Winslow Taylor, a well-known engineer, died at Germanstown, Pa., on March 21, aged 59 years. The late Mr. Taylor was the pioneer of scientific shop management and methods.

John G. Twiton, secretary-treasurer of the Australasian branch of the Massey-Harris Co., of Toronto, died March 18, at Melbourne, Australia, from injuries received in a motor accident.

Frank Edward Norton, manager of the Norton Telephone Mfg. Co., died at St. Michael's Hospital, Toronto, on Feb. 19. Mr. Norton was born in Fort Covington, N.Y., and was in his fiftieth year.

Richard Schofield, member of the Toronto firm of Schofield-Holden, died on Feb. 26, at San Francisco, Cal., as a result of an operation for appendicitis. Mr. Schofield was in his fifty-ninth year.

William Bissett Smith, general manager of the Dominion Transport Co., died in Montreal on November 8, in his 87th year. He was born in Huntley, Aberdeenshire, and came to Canada in 1855.

Maximilian Eugene Duncan, vice-president and general manager of the Canadian Car & Foundry Co., died on May 23, in Montreal. Mr. Duncan was born in New York City on March 28, 1862.

Col. Davenant Roger, a prominent Canadian civil engineer, died in Brooklyn, N.Y., on Jan. 20, in his 63rd year.

Col. Roger played a prominent part in the building of the C.P.R. and the Cape Cod Canal.

John Fox Lindsay, financial manager of the Canadian Consolidated Rubber Co., died after a brief illness at his home, Albany avenue, Toronto, on December 26.

A. J. Somerville, for some time president of the Ontario Lead and Wire Co., died at Toronto on March 28. Mr. Somerville was born at Huntington, Que., in 1844, and came to Toronto some 40 years ago.

J. Frank Chapman, general manager of the Thousand Islands Railway and the Oshawa Railway, passed away in July, at his residence in Gananoque, Ont. The deceased was born in Frankford, Ont., in 1863.

Hon. Geo. A. Clare, M.P., president of Clare Bros. & Co., stove manufacturers, died at Preston, Ont., on Jan. 9. Mr. Clare was born at Preston in 1854, and had been a member of the Dominion Parliament since 1900.

Saxon F. Shenstone, treasurer of the Dominion Radiator Co., died at his home in Toronto on December 25. The deceased was born in Brantford 37 years ago. He began his business career in Hamilton, and joined the Dominion Radiator Co. seven years ago.

Duncan Clark, purchasing agent of the Canadian Vickers, Ltd., Montreal, Que., died on December 21. The deceased, who was born in Scotland, came to Canada two years ago and joined the Canadian Vickers, Ltd. Mr. Clark was a man of wide experience in ship construction work, and had been employed in various shipbuilding yards on the Clyde.

Thomas Coltrin Keefer, C.E., C.M.G., LL.D., one of Canada's most noted engineers, died at his home in Ottawa, on Jan. 7. Mr. Keefer was born in Thorold, Ont., and began his engineering career in 1836. In addition to his work on railway construction, Mr. Keefer was an authority on harbors and waterworks, being connected during his long career with many important undertakings.

Sir William Cornelius Van Horne, K.C.M.G., at one time president of the C.P.R., died in Montreal on September 11, following a comparatively brief illness. Sir Wm. Van Horne was born at Joliet, Ill., on February 3, 1843, devoting practically his whole life to railroad work. In recent years he took a leading part in railway development in Cuba, and he has been interested in many large railway, industrial and financial enterprises.

Thomas Leopold Willson, a well known engineer and scientist of Ottawa, Ont., died in New York on December 20. Mr. Willson was born in Princeton, Ont., in 1850, and was educated at the Collegiate Institute, Hamilton, Ont. He made many scientific discoveries during his career, the most important being in 1888 when he evolved a method for producing acetylene gas from calcium carbide and utilizing it for illuminating purposes on a commercial basis. Acetylene gas had been known for some years previously, but no method was known of generating the gas in sufficient quantities for ordinary use. Mr. Willson's discovery thus revolutionized this system of illumination. Mr. Willson also invented and perfected mechanical apparatus for bringing this gas to a practical use. One of these devices was an acetylene gas buoy, now in use as an aid to navigation all over the world. His most recent discovery was that of a chemical fertilizer, for the production of which he had received a large concession from the Newfoundland Government.

NEW WAR LOAN COMING

AN intimation that there may be a further Canadian loan, and that its amount may be $300,000,000, was given by Sir George Foster, Minister of Trade and Commerce, in an address before the People's Forum in Ottawa, a few days ago.

Sir George, after pointing out that finance was a vital factor in the present war, stated that the people of this country had already subscribed a $100,000,000 loan. If necessary, and Sir George appeared to think it might be, they could subscribe $300,000,000.

"During seventeen months of the war we have done nothing specially to tax ourselves in Canada," said Sir George, and I am certain that the people of Canada as a whole have a very inadequate sense of the gravity of the world situation which is facing us."

There were three prime factors in the war—men, munitions and third and most important, money. How long would Canada go to the Mother Country and ask her to finance her expenditure?

"We have the money. There are two sources—what the people have earned and saved. If the latter is not enough, when all your savings are gone we will come to you for your earnings. I believe there is not a man in Canada, if he values his country and citizenship, will refuse the call."

CENSUS OF CANADA'S INDUSTRIES

A CENSUS of Canada's industries and manufactures will be taken by the Census and Statistics Department, Ottawa, between January 1 and 21, 1916. In order to make the data to be procured of immediate service and value, the commercial and industrial interests concerned are requested to give prompt attention to the schedules which have been distributed in the matter of having them filled in correctly and completely. Where less than three industries of a kind are to be found in a district, province, or in the Dominion, presentation will be made in the final statement under the heading of general.

The information called for will be treated as strictly confidential, will not reveal any individual business, will not be used as a basis of taxation or other liability, and will not be disclosed to any municipal or provincial authority, or to any other Department of the Dominion Government. The contents of the schedule will show number of employees, wages paid, salaries paid, capital employed, materials of production, products manufactured, days of plant operation, etc.

As a special object of this particular census is to measure the extent to which Canada's industries have been affected by the war, products for general or peace time purposes are required to be stated separately from those attributable, directly or indirectly, to war account.

INDUSTRIAL PEACE PREVAILS IN CANADA

A SITUATION which promised for a time to become serious has been brought to an amicable close by a notification from the Canadian Northern Railway to the Labor Department at Ottawa of the company's acceptance of the findings of the Conciliation Board, which recently passed upon the dispute with its locomotive engineers and firemen. As a result of this finding, employees on the Eastern Lines of the C.N.R. system secure considerable benefit in wage rates and conditions.

The acceptance of the award by the railway company leaves the industrial situation in Canada peaceful beyond all precedent during the fifteen years covered by the Labor Department records. Not one strike is reported as existing from sea to sea, and there is no indication of serious friction at any point, although Conciliation Boards at the moment exist at St. John, N.B., where the 'longshoremen are negotiating a new agreement with the ship-owners; and at Edmonton, where the street railway men are seeking a new agreement with the municipality.

Work continues peacefully at both points pending the investigations, and, as the dispute in neither case presents any serious difficulty, there is every reason to suppose the various boards will be able to effect working agreements.

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Vol. XIV. DECEMBER 30, 1915 No. 27

THE SHELL COMMITTEE, ITS WORK ITS JUSTIFICATION

DURING the past week much currency was given the report that Brig.-Gen. Bertram, deputy chairman, and C. B. Gordon had resigned from the Imperial Munitions Board, recently constituted at Ottawa. Unqualified denial has been given the rumors, and indications are not wanting that as regards the sponsors of the latter, the wish was father to the idea. Slugging the late Shell Committee and fawning on its more impressively titled successor seem to afford a never-ending opportunity and provide an ever-ready theme—although worn threadbare long ago, for the display of vituperation and the formulating of odious comparisons.

The constitution of the Shell Committee was in its every feature a new departure so far as this Dominion was concerned, and, like every other new undertaking, but more so because of the lack of precedent as a guide, the needed development of administration, the investigation into our metal-working plant resources and their pressing into service at highest possible individual capacity rating, accomplishment of results was necessarily slow in the earlier stages. Achievement did come, and for the greater part of these last twelve months we have been reaping the benefit of deliberate, responsible, conscientious application on the part of the Shell Committee executive to the work of utilizing our metal-working plant resources to an extent never before believed possible.

Our manufacturing capabilities since the advent of shell making have developed one hundredfold, and but for the effort expended in experimenting with and mastering the details of shell production by Brig.-Gen. Bertram and Col. Cantley—the two best abused men in Canada to-day, business inactivity and war aggravated poverty would have been rampant with us. The services rendered by both men are appreciated to the full by every right thinking and properly informed citizen of this Dominion, and such accomplishment as may be achieved by the Imperial Munitions Board will constitute but the superstructure to the foundation which they have so well laid.

Brig.-Gen. Bertram is to be commended for sticking to his re-appointed work, even though it does exasperate his detractors. It proves him to be a man, clean, honest and upright in whatever he undertakes, and makes the most effective weapon of defence he can employ to silence his ill-advised and equally ill-informed critics.

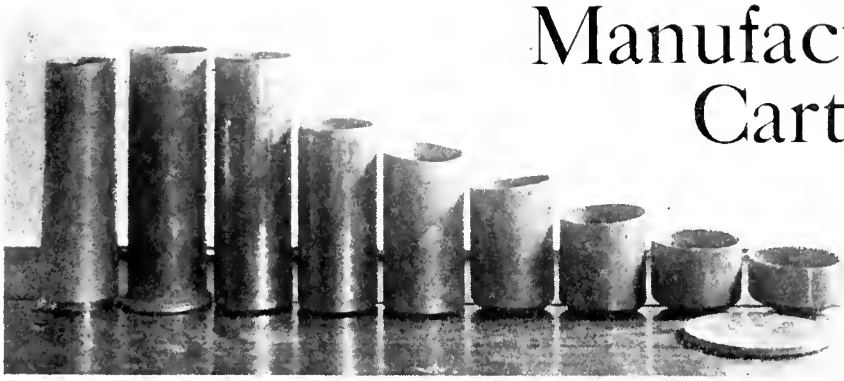
TAXATION OF WAR PROFITS

THERE is a manifestly growing tendency towards the belief that our manufacturers engaged in the production of munitions of war are waxing rich, and expression has been given the idea by suggesting that the time is opportune to tax their profits—or more properly, their super-profits on behalf of our national revenue.

Our present metal-working plant activities have no parallel in the past, for the reason that no such demand as that existent, and no such quantity specialty were aforetime realizable. The manufacture of shells has brought about a new conception of and given a new standard to plant capacity. Has it, however, enabled us to do much more than get on a par of sufficiency and efficiency with older established nations in catering more fully to our own needs and acquiring an entrance to or appropriating more of the world's trade? We believe little beyond this has yet been accomplished, and in the matter of profits being realized, no Canadian manufacturers, we believe, are netting more than arise from long, continued capacity operation. War profits taxation is, to say the least, a somewhat indefinite proposition. It has the earmarks of being so comprehensive in its scope as to even include normal business revenue arising out of war orders, and there is little doubt that such an intention is implied. On such a basis, taxation of war profits so-called is sure to meet with strong opposition and remonstrance

Overmuch irresponsible glorification of our munitions' production achievement has been broadcast, and, still more unfortunate, overmuch stock market play has been indulged in. The tax gatherer as well as the man in the street note particularly the latter circumstance, but find difficulty in determining whether abnormal manufacturing profits are being pocketed by our large corporations engaged in the production of munitions or whether "lamb fleecing" only is being assiduously prosecuted. The stock market records of recent months have had more to do with the initiation of the movement towards war profits taxation than all other evidences or reasons combined.

Will the placing of a War Profit Tax reveal the situation, or will its application be lacking in scope and therefore effect? Unless all business arising out of the manufacture of war munitions, fulfillment of other war contracts, and stock exchange values of concerns engaged in these, are under direct Government control, it seems to us futile to even attempt legislation. Judiciously placed fair profit contracts would render super profits unobtainable, thereby obviating the necessity for a War Profit Tax.



Manufacturing Brass Cartridge Cases for 18 Pdr. Shells

Staff Article

When the problem of producing brass cartridge cases first came before Canadian manufacturers, one of the chief drawbacks to immediate output was the inability to secure the necessary special equipment. The plant here described, upon making inquiries, found that delivery of the latter could not be made within nine months. However, being obsessed with the desire to bear a part in meeting our Empire need, the management got to work and adapted their existing machinery to the purpose, achieving success exceeding every expectation.

THE work of producing brass cartridge cases for 18-pdr. shells is characterized by some interesting metal drawing operations which, along with the annealing processes, constitute the greater part of the work. The metal from which these cases are made has to conform to close physical specifications after being worked; a certain tensile strength is indispensable, and is closely indicated by certain limits of hardness on the scleroscope testing machine. The composition of the metal is approximately 70 per cent. of copper and 30 per cent. of zinc.

The blanks that are used in the making of cartridge cases are seldom produced in the plant where the cases are being manufactured, as it is more economical to purchase these from some outside source, where the production of this class of work is carried on continually.

These discs are 6.22 in. in diameter, .380 in. thick, and are punched from a sheet which has previously been rolled to this thickness. When the discs are received at the drawing plant they are usually in an annealed condition, ready for the first operation. The plant from which the accompanying data was obtained performs this cupping operation on a large Niles-Bement-Pond bulldozer, a view of which is shown in the rear of Fig. 1. The cup as it comes from the press has an outside diameter of 4.5 inches, and a height of about 2.625 inches, with wall of an approximate thickness of 17-64 inch.

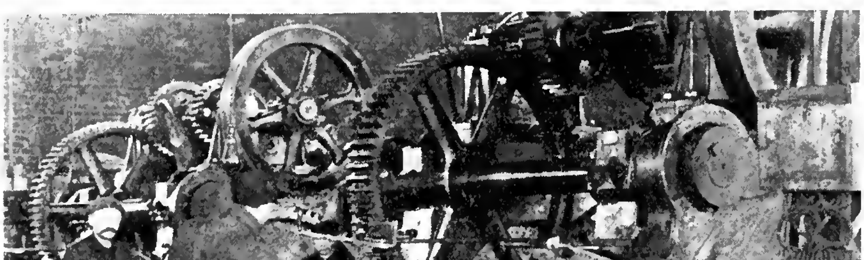


FIG. 1. FIRST AND SECOND OPERATIONS BEING PERFORMED ON A BULLDOZER.

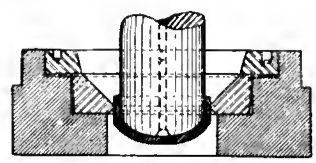


FIG. 2. SECTION OF CUPPING DIE.

A sectional view of this cupping die is seen in Fig. 2. The upper surface of these dies is beveled at an angle of 45 degrees to facilitate the action of the metal. The details of the first drawing die are shown in Fig. 3. In this case the angle of draw surface is about 15 degrees off the direction of the draw.

Annealing the Shells

To restore the ductility of the metal, which the drawing and redrawing operations tend to destroy, it is necessary to thoroughly anneal the brass before each redrawing operation. The furnaces used for the heating of these semi-finished cases are of the continuous type, built by the Quigley Furnace Co., equipped with Bristol recorders; a view of these furnaces is shown in Fig. 4. Open-

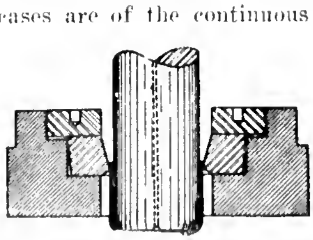


FIG. 3. SECTION OF FIRST DRAW DIE.

FIG. 4. ANNEALING FURNACES SHOWING CHARGING ARRANGEMENT.

ings are provided at each end to allow the trays to pass completely through the furnace during the process of heating. The sheet metal trays, holding about 60 cases, are placed upon steel frame buggies, the tables of which are on a level with the bottom edge of the fire chamber.

To operate the furnace, one of these trucks with a loaded tray is wheeled into position before the charging entrance; the fire door is raised and the tray shoved into the furnace by the action of the ram—operated by compressed air—shown in the foreground. This process is repeated every six minutes, and with the furnace containing a charge of six trays the time taken to heat the shells to the desired temperature of 1,150° F. is about 36 minutes. Rollers are provided on the trucks, and also on the bottom of the furnace chamber, to facilitate the progressive movement of the trays through the furnace.

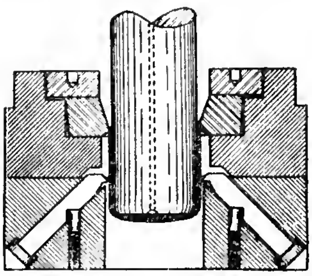


FIG. 5. SECTION OF SECOND DRAW DIE.

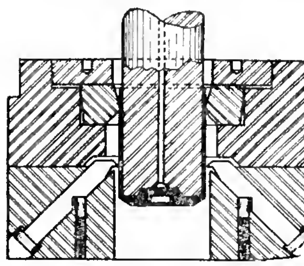


FIG. 6. SECTION OF THIRD DRAW DIE.

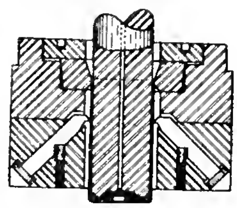


FIG. 6a. SECTION OF FOURTH DRAW DIE.

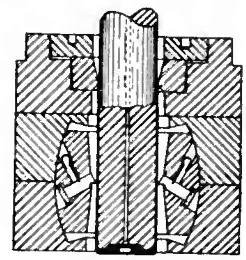


FIG. 6b. SECTION OF FIFTH DRAW DIE.

When the cases reach the far end of the furnace, and have attained the required degree of heat, they are taken out and placed on an elevator platform, which is lowered into a vat of water by means of a compressed air hoist, directly over the cooling bath. Some cartridge case manufacturers prefer to let the cases cool off in the air, believing that the sudden cooling of the immersion method affects the physical properties of the brass. Many concerns, however, have found the water cooling method perfectly satisfactory, and as this process is much quicker than air cooling, it has been generally adopted. From the cold water bath they are placed in a weak solution of sulphuric acid for a period of 12 minutes, then dipped in a bath of diluted potash solution, afterwards being thoroughly rinsed in hot water.

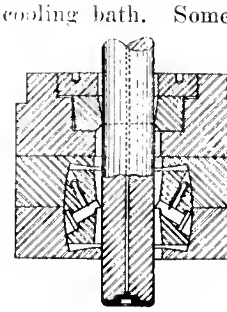


FIG. 8. SECTION OF SIXTH DRAW DIE.

First and Second Redrawing Operations

The first redrawing on the cups is also done on a Niles-Bement-Pond bulldozer, shown in the foreground of Fig. 1. The cups are dipped in a lubricating solution of soap and water, and placed upon the nose of the redrawing punch; these punches are provided with a vent hole through the centre to allow the enclosed air to escape freely. If the punches were left solid, this air would in all probability be compressed to such a pressure that the case would be seriously buckled or possibly destroyed. The operator is shown in position just after having placed one of the cups upon the nose of the punch. As the advancing ram forces the die over the punch, the metal is drawn upwards around the punch; the size of the case after the first redrawing operation is about 4.219 in. outside diameter x 3.5 in. high, with a wall approximately 11-64 inch thick.

The shells are again annealed in the same manner as previously described, and then redrawn on the opposite side of the large bulldozer shown in Fig. 1.

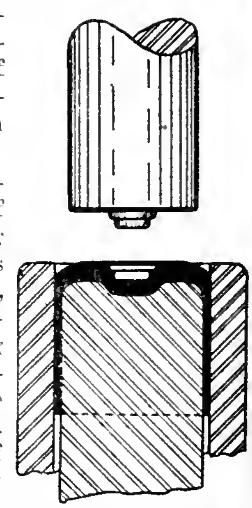


FIG. 6c. SECTION OF INDENTING DIE.

Fig. 5 is a sectional view of second drawing die, which is similar to Fig. 3, with the addition of stripping fingers to remove the case from the punch. The details of the third draw die are seen in Fig. 6. Oil and

FIG. 7. TRIMMING CARTRIDGE CASES BEFORE TAPERING.

tallow with soap and water are the lubricants used.

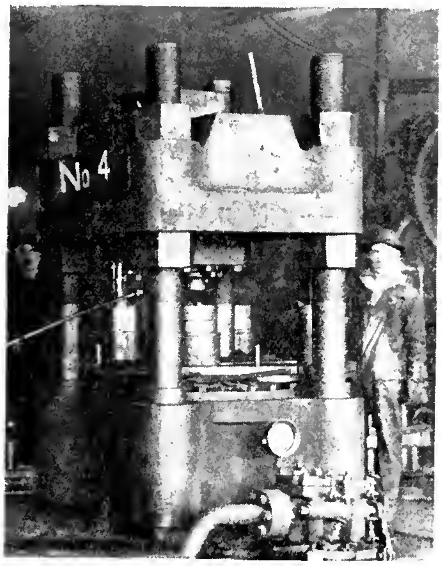


FIG. 9. HEADING CARTRIDGE CASES ON 500-TON HYDRAULIC PRESS.

First Indenting

The semi-finished cases now receive their first indent or impression in the base. This is performed on a Niles hydraulic press, equipped with special table fitted with dies. This table is permitted to revolve about one of the standdards of the press, and can be locked at each quarter turn, when the stationary punch and one of the dies are in working position. The ram of the press is forced upward and the impression made in the base of shell; as the ram descends the case previously indented is ejected from the die.

FIG. 9a. SECTION OF HEADING DIE.

After receiving this first indent, the cases are again passed through the annealing process in preparation for the third redrawing operation.

FIG. 10. ANNEALING FURNACES PREPARATORY TO TAPERING CARTRIDGE CASES.

Third and Fourth Redrawing and Second Indenting

These operations are very similar to that of the second redrawing, and are performed on Niles-Bement-Pond bulldozers like those shown in Fig. 1, but smaller.

Between each redrawing operation it is necessary to anneal the cases to remove the brittleness induced in the metal by the action of the dies and punches.

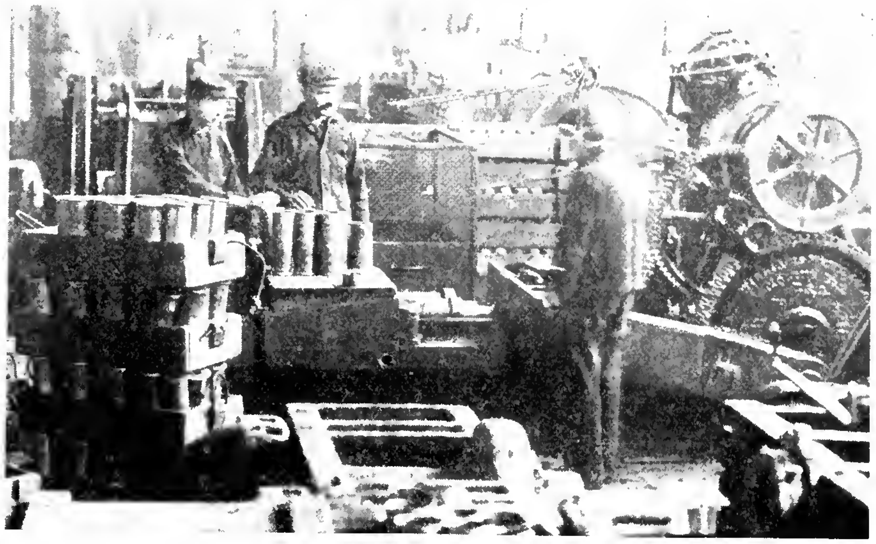


FIG. 11. TAPERING CARTRIDGE CASES ON A BULLDOZER.

The respective dimensions of the shells after the third and fourth redraw are 3.97 in. and 3.84 in. in diameter, with lengths of 5.75 and 8.25 in., the thickness of the metal in the wall being 3-32 and 3-64 in.

Prior to the shells receiving their second indent—which is performed in the same press as that used for the first—a small hole is drilled in the centre of the base to permit the escape of the contained air.

Fifth Redraw and Preliminary Trimming

The partly completed cases are again annealed and taken to an old Niles-Bement-Pond planer having the draw-punch mounted on the cross-slide, supported by the side frames, the dies with stripping fingers being held on a fixture bolted to the movable table.

The general construction of this die

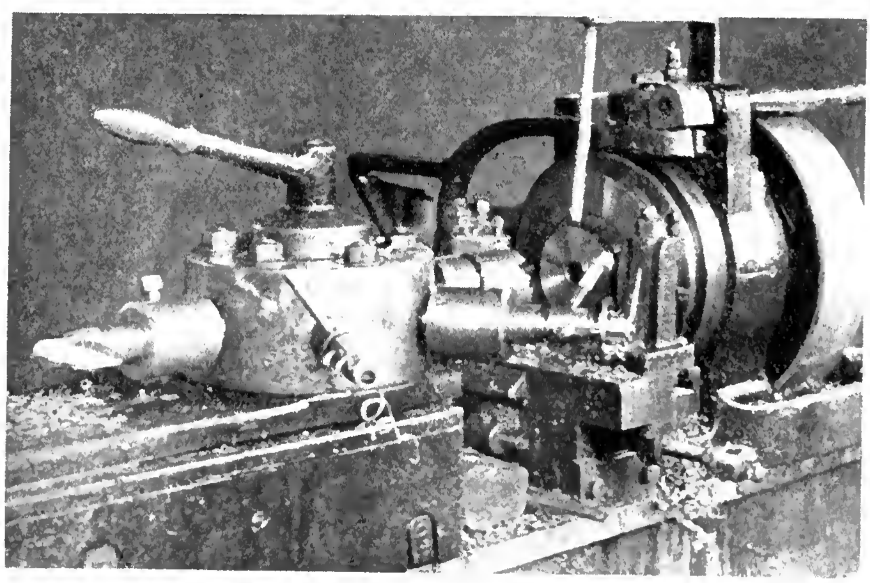


FIG. 12. MACHINING HEADED END ON SINGLE PURPOSE LATHE.

and also that for the sixth re-drawing operation is shown in Fig. 8. The case at this stage has an outside diameter of 3.78 in. and about 10.6 in. long with a wall of about .03 in. thickness.

The cases are now taken to a Canadian Car and Foundry trimming machine shown in Fig. 7. and the open end trimmed off, leaving the shell 10.5 in. long. The trimmer used was made from an old lathe with a mandrel secured to the spindle and a cutter placed in the desired position. A rest is bolted to the bed of the lathe and carries a pinion secured to a short shaft, the outer end of which connects with a lever. The raising of this lever forces the slide forward and the case is cut to the required length.

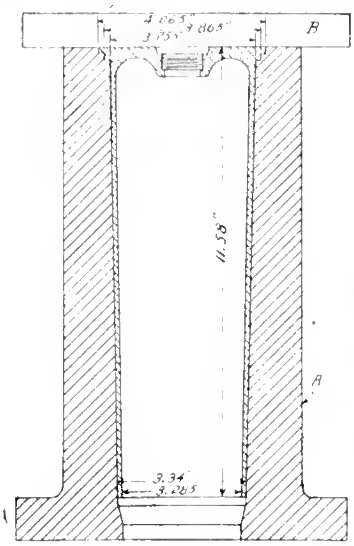


FIG. 14. GUN BARREL TEST GAUGE.

Sixth Redrawing and Final Trimming

The cases are again annealed by the cold bath process and taken to a Williams & White bulldozer partly shown in the foreground of Fig. 11. The die used on this operation is similar to that shown in Fig. 8. and the shell as it comes from the die is over 13 inches in length with an outside diameter of 3.39 in.

The cases now receive their final trimming and are cut to an overall length of 11¾ in. This is also performed on a device similar to that shown in Fig. 7.

FIG. 15. GENERAL VIEW OF FINISHING AND TESTING DEPARTMENT.

Heading the Cases

The operation of heading the cases is done in a large 500-ton hydraulic press made by the C. P. Railway and is shown in Fig. 9. The man to the right places the cases in the die, and disengages and revolves the table to working position: the operator in the centre now permits the ram to ascend, when the punch on the upper bolster makes the first impression. The ram is now lowered and the operator to the left with rod in hand places the auxiliary block over the nose of punch; the lower part of this piece finishes the heading when the ram is again forced upward. When the table is revolved so that the finished case is before the centre operator a small pneumatically operated ram ejects the headed case, which is shown in the figure about to be removed. Two similar presses are used on this operation with an average output of about 180 an hour.

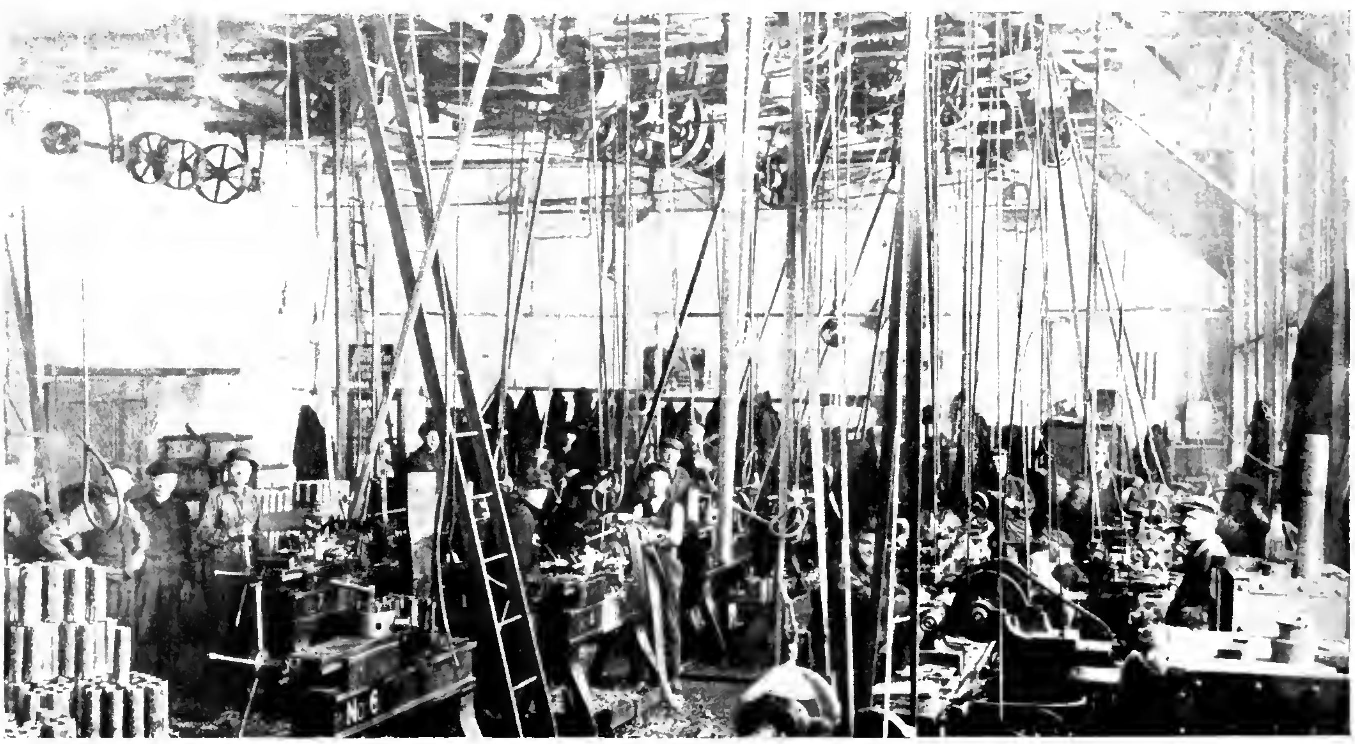


FIG. 13. GENERAL VIEW OF CARTRIDGE CASE MACHINING DEPARTMENT.

Annealing and Tapering

After the cases have been headed they are ready to be tapered; but it is neces-

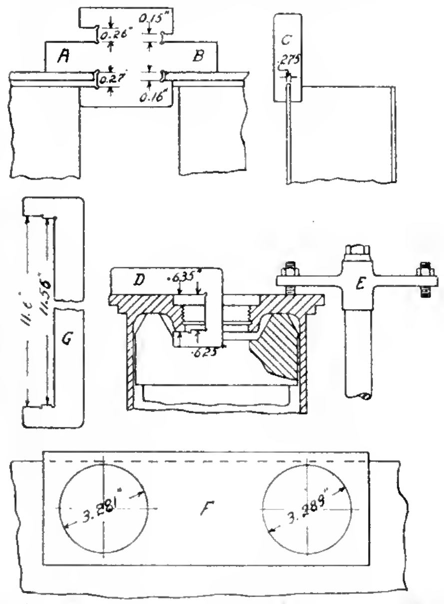


FIG. 16. VARIOUS TYPES OF GAUGES.

sary that the upper portion of the shell should be annealed before closing. The furnaces used for this purpose are shown in Fig. 10, and were constructed by the Canada Car and Foundry Co. The operator with a pair of tongs places the case in the fire chamber from below and permits it to rest upon a post, which revolves constanly by means of a small pneumatic drill arranged below the furnace. The shell is allowed to remain exposed to the fire for about 45 seconds and is heated for a distance of

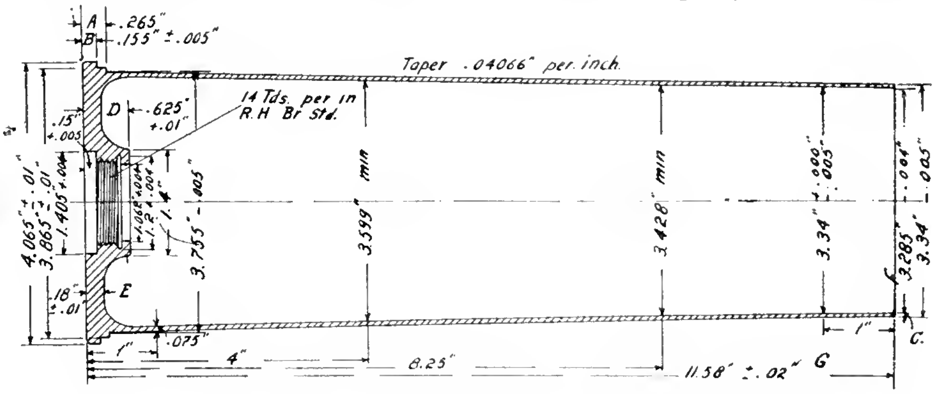


FIG. 16a. PARTICULARS OF FINISHED 18-PDR. SHELL CARTRIDGE CASE.

5 or 6 inches from the open end, after which it is allowed to cool in the air.

During this annealing operation, it is essential that the cases be heated very evenly and cooled uniformly to insure the metal being of suitable softness throughout, as irregular annealing will cause the case to buckle or produce walls of uneven thickness, while undergoing the tapering process.

The tapering operation is performed on a Williams, White & Co. bulldozer, shown in Fig. 11. Two operations are required: the operator on one side places the case in one die to receive the first taper, and on the return stroke of the press, this partly finished case is removed and handed to the other operator, who places it in the other die for the finish tapering.

In the first operation the case is tapered for a distance of about 6 in. from open end and the final tapering opera-

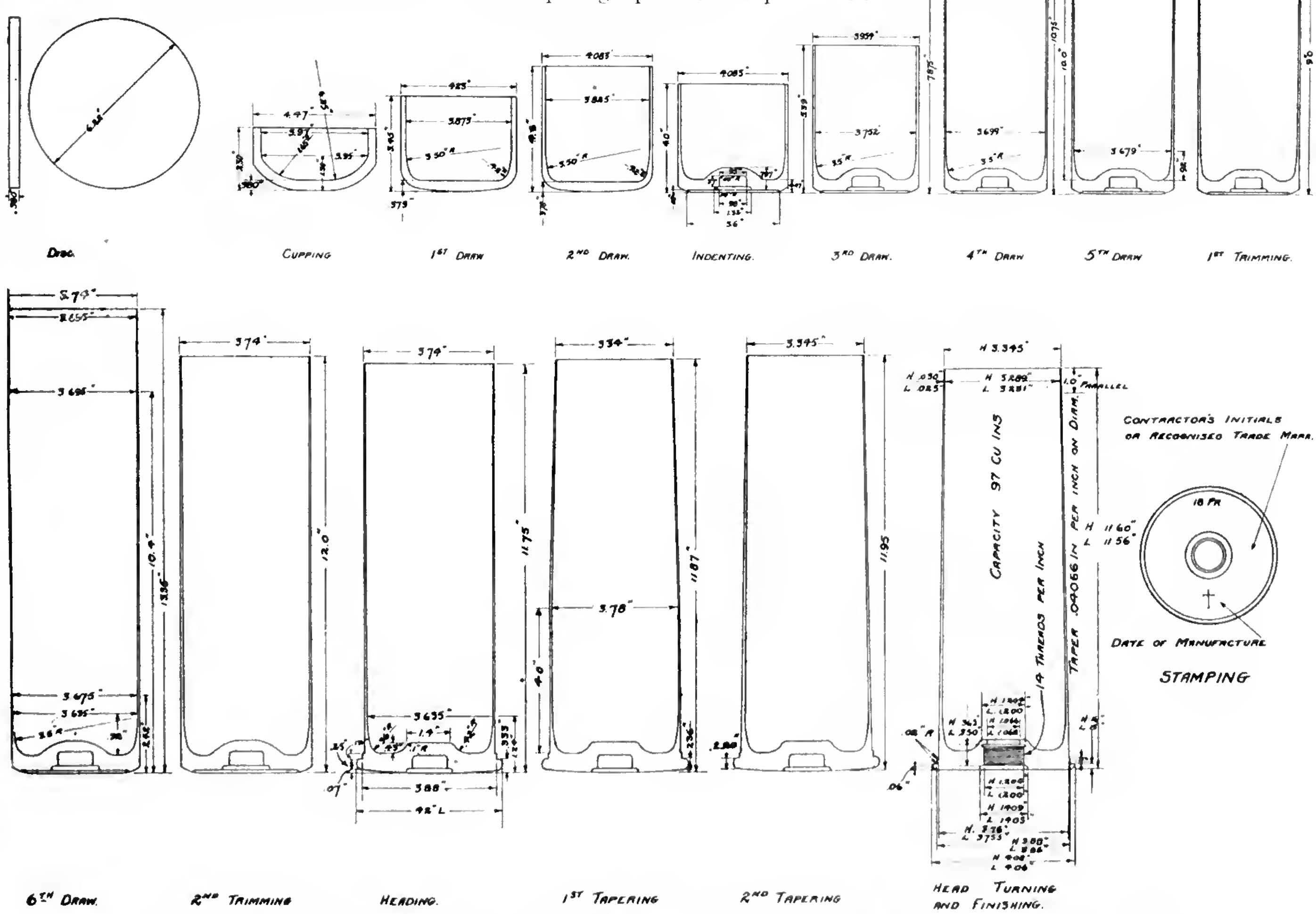


FIG. 16b. CARTRIDGE CASE FOR 18-PDR. Q.F. SHELL, IN ITS VARIOUS STAGES OF MANUFACTURE.

tion leaves the mouth of the case parallel for one inch, having an outside diam. of 3.34 in., with an allowable limit of —.005 in. The taper of barrel is about .0407 in. on the diameter for every one inch in length.

Machining the Headed End

The cases have now passed through all the drawing operations and are taken to the machining department for the final work before inspection.

Six C. M. C. and three Bullard single-purpose machines with turret heads are used on these operations. A view of one of the C.M.C. lathes is shown in Fig. 12. The cycle of machining follows: Rough bore primer pocket; face head; form with tool on rear of carriage; recess at base of thread; tap with Murchey collapsible tap; ream with combination reamer. A general view of the machining department with a section of the tool room on the right, is shown in Fig. 13.

Preliminary and Final Inspection

In Fig. 15 is shown a section of the finishing and testing department. A Noble & Westbrook marking machine is seen in the left foreground; this is for stamping the head. At the extreme left are several operators sizing the primer hole with hand taps. A plentiful supply of compressed air is available for the removal of cuttings.

Before the cases pass to the Government inspectors, they are carefully examined by the shop inspectors. The regular routine of testing is: 1st, thickness of head, shown at E, Fig. 16; 2nd, taper of barrel by snap gauges; 3rd, complete length, G; 4th, outside of head to base of primer, D; 5th, hole diameter, plug gauge; 6th, root of thread; 7th, lower rim, snap gauges; 8th, head thickness, A; 9th, flange thickness, B; 10th, diameter of outer counterbore, plug gauge; 11th, pocket recess; 12th, thickness of wall, C; 13th, testing diameter of mouth, F; 14th, gun barrel test shown in Fig. 14. The case must fit freely, yet closely, into the cast iron gauge, A, and the straight-edge, B, must pass clear above the head.

The dimensions with the high or low limits are shown in Fig. 16a. In some instances the minimum sizes are given with the allowable limit above, as these dimensions must not be below the size specified.

In addition to the gauging of the sizes within the limits indicated, the effects of the annealing operations have to be carefully checked by means of the scleroscope. The readings adopted vary with different plants, as slight differences in the composition of the metal may alter the final reading. As a general statement, it may be said that when the metal is too soft, the case may receive a permanent set under the pressure of the explosion in the gun chamber, causing it to stick or jam. On the other hand, metal which is too hard may develop cracks in course of manufacture and use, which is equally objectionable. Every effort is made, therefore, to avoid damage to the alloy when preparing the metal, as carelessness in this respect cannot be counteracted at a later stage either by heat treatment or mechanical means.

FIG. 17. GROUP VIEW OF CARTRIDGE CASES AT VARIOUS STAGES OF COMPLETION.

A group view of the various stages of completion is shown in Fig. 17; from right to left the operations are as follows:—Blank, cup, first draw, second draw, first indent, third draw, fourth draw, second indent, fifth draw, sixth draw, trim, first taper, finish taper.

The present output of this plant is about 2,200 cases per day.

MELTING POINT OF TUNGSTEN

THE intrinsic brilliancy of tungsten filaments just before melting is, according to Irving Langmuir in a recent issue of the Physical Review, 7,200 international candles per square centimetre. This would, in accordance with the constants of Nernst, Pirani, Wartenberg, and Coblentz, correspond to a melting-point of tungsten of 3,540 deg. Cent. absolute instead of the previously accepted value of 3,200 deg. Cent. As the presence of minute amounts of hydrocarbon vapors (from the vaseline or stop-cock grease) made these determinations somewhat doubtful, Langmuir recently re-determined the melting-point of tungsten by two methods.

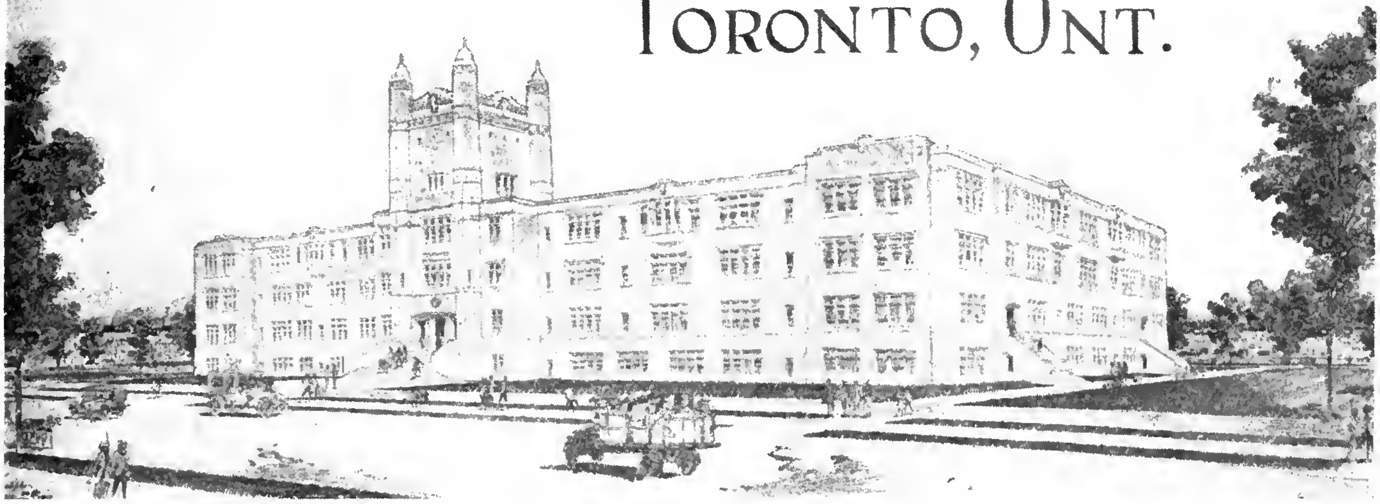
In the first he determined the black-body melting point of large filaments in nitrogen, while estimating the emissivity of helically-wound filaments of various sizes in vacuum and in nitrogen. In the second, he measured the brilliancy of a surface of molten tungsten, simultaneously determining the brilliancy of the image of a second surface of molten tungsten reflected in the first; thus he directly determined the reflectivity of the molten metal. For this purpose he made use of an alternating arc between tungsten electrodes in nitrogen; the ends of the two wires formed convex molten surfaces showing multiple reflections of the two electrodes which could be watched for an hour or more. The resulting melting-points of three determinations were: 3,540, 3,532 and 3,566 deg. Cent. absolute, the value 3,540 being the most probable.

WHITE STAR LINER BRITANNIC COMPLETED

THE largest British-built steamer, the White Star liner Britannic, was recently completed, and placed in dry dock at Belfast preparatory to starting on a few days' trial trip. The vessel is one foot shorter than her Cunard rival, the Aquitania, but is 3,000 tons heavier in gross register. Forty-eight lifeboats are carried, which can be lowered on an even keel, even though the ship be down by head or stern, and there is a device for transferring the boats across the deck so that all can be lowered on either side. The gross tonnage is 50,000. Other particulars are nine decks; 900 feet long; accommodation for 2,600 passengers, and a crew of 1,000; sixteen transverse bulkheads and a double skin; rudder weighing over 100 tons; furnaces numbering 150; wireless telegraphy with a range of 2,000 miles. The Britannic was launched about eighteen months ago, and has cost over one and a-half millions sterling.

New Central Technical School

Toronto, Ont.



Staff Article

The year 1915-16 will be memorable in the annals of technical education in Canada. The additional facilities afforded by the new building were expected to be more than ample, but the excellence of the arrangements has so increased the demand for tuition that overflow attendances in all departments have taxed the new institution to the limits of its capacity.

IN the year 1891 A.D. the City of Toronto organized evening classes, which were held in a building known as Wycliffe Hall, the classes being conducted under the name of the Toronto Technical School. Ten years later the increased demand for technical education had necessitated the purchase of a building of considerable size adjacent to the University buildings, day classes being added to the evening classes at this time. In 1904 the Technical School Board, the High School Board and the Public School Board were replaced by the present Board of Education, and under this board the school was organized as a Technical High School.

In 1911 the school was placed under the management of an Advisory Industrial Committee, appointed by the Board of Education. This committee consists of twelve persons, six of whom are selected from the Board of Education, and six from the manufacturing or other industries; three of the latter being employers of labor or directors of companies employing labor, and three being employees.

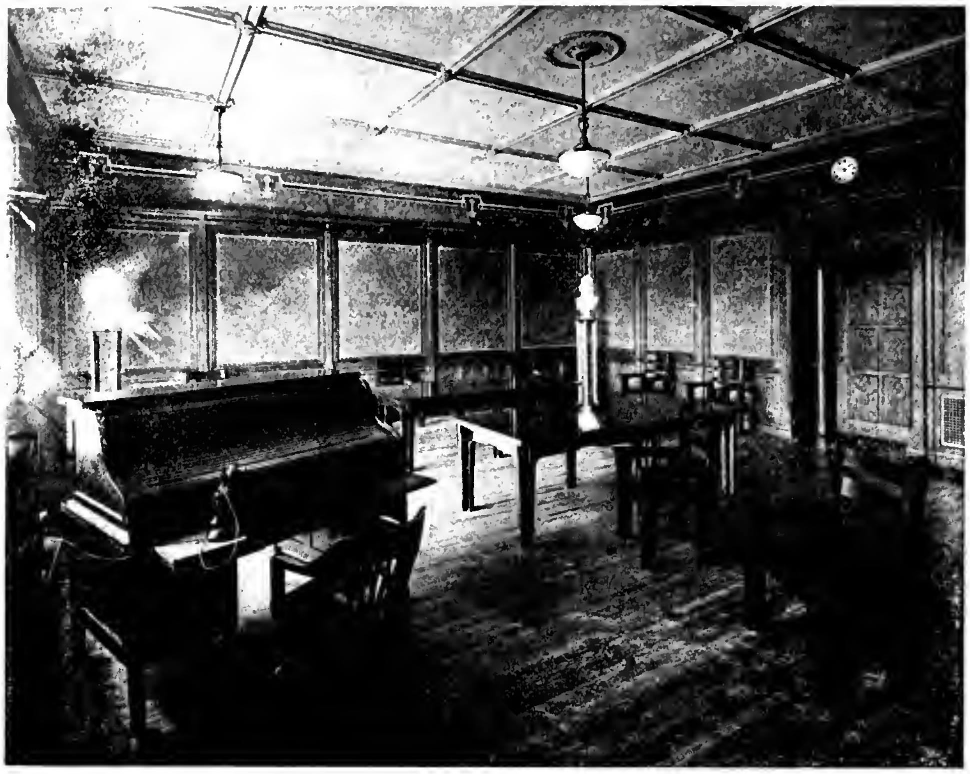
In November of that year, and twenty years from the organizing of the original Toronto Technical School, the Advisory Industrial Committee, acting under the recent Industrial Education Act, adopted a scheme of reorganization, which culminated in the erection and equipment of the magnificent edifice known as Central Technical School, Toronto.

A. C. McKAY, B.A., LL.D.,
Principal of New Technical School.

In conjunction with the Central School are four branch technical schools, which are situated in selected locations in the suburban districts; but it is with the Central School, its building, its equipment, its facilities for the dissemination of knowledge, and its devoted staff and enthusiastic pupils, that this article deals with primarily.

Instances frequently come to light where men, handicapped by lacking of opportunity for acquiring knowledge in their young days, have succeeded in surmounting many difficulties and ultimately achieved notable success in industrial life. The world-wide recognition of the value to a nation of an intelligent, educated population, trained to develop its own leaders and workers in industrial life, has been the compelling force of the immense advance in technical education in the

leading civilized countries. The phenomenal development of all classes of industry in America during the last three decades has been facilitated in no small degree by the efficient and complete education offered by numerous scientific schools and institutions which have kept in close touch with the leading manufacturing concerns on the continent.



BOARD ROOM AND OFFICE OF PRINCIPAL.

In the university departments of applied science in Toronto and Montreal, Canada has excellent educational institutions, which enable scientific knowledge to be acquired in a high degree of completeness, but the great number of young people desiring to acquire a useful knowledge of arts and crafts, trades and special industries, have not been given the facilities which are their moral due.

The scheme of reorganization adopted by the Advisory Industrial Committee stated that in the Central School there should be organized the following courses:

For Day Pupils:—

(a) Industrial courses (general and special), extending over four years for boys, and over three years for girls; one-half of the time in the last two years in each course to be devoted to actual shop practice.

Pupils to be admitted to these courses are required to present a certificate of having obtained at least fourth form standing in a public or separate school.

(b) Matriculation courses, extending over four years, admitting to university departments of applied science and household science.

Pupils to be admitted to these courses are required to be duly qualified to enter a high school.

(c) Special short courses of theoretical and practical technology, including courses for part-time students; pupils to be admitted at the discretion of the principal.

(d) Courses in fine and applied arts, with special adaptation to the industries; pupils to be admitted at the discretion of the principal.

For Evening Pupils:—

(a) Industrial courses, with practical demonstrations under the direction of skilled workmen, open only to those actually engaged in the trade or occupation.

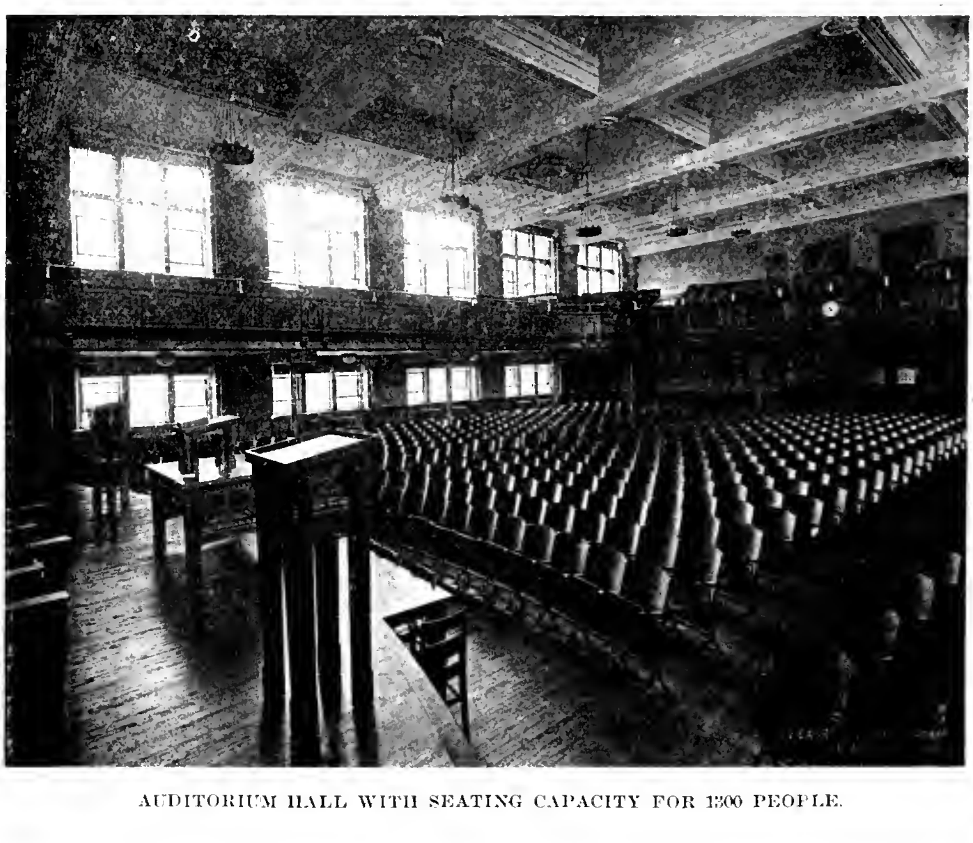
(b) Technical courses, including theoretical and applied mathematics.

(c) Art courses, with special adaptation to industries.

(d) Domestic science courses.

A study of these provisions reveals to a slight extent only the amount of detailed labor and thought involved in organizing the new educational plant. To remove an organization with its existing equipment, which was already of considerable proportions, into new quarters six or eight times as large, to increase the staff, to extend the equipment, to maintain every administrative and executive detail in a high state of efficiency, and then, in spite of all precautions, to be overwhelmed with an avalanche of students beyond all previous estimation—such in brief has been the fortune of Dr. A. C. McKay, B.A., LL.D., principal of Central Technical School.

The site of the school extends to about six acres, and occupies two city blocks. It is bounded by Lennox, Harbord, Borden, and Lippincott Streets. The main entrance is on the west side facing Lip-

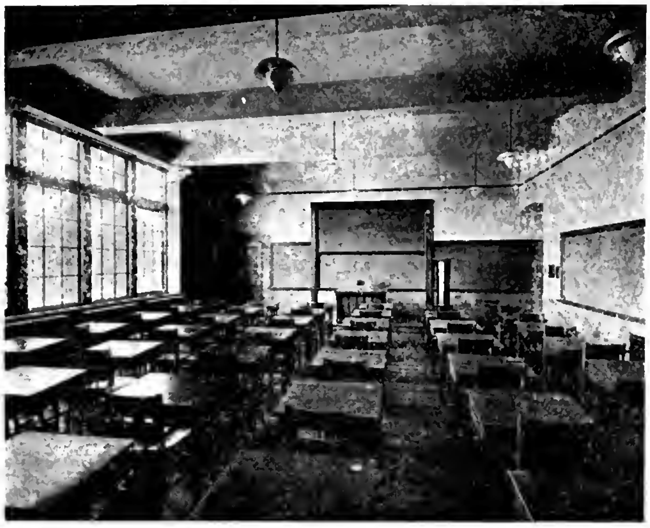


AUDITORIUM HALL WITH SEATING CAPACITY FOR 1300 PEOPLE.

pincott Street, the length of the building north and south being 430 feet by 227 feet deep, and four storeys in height. The size of the site allows for the accommodation of a football field at the north end and tennis courts at the south end. The location of the school is in

Elaborate arrangements are provided for the comfort and convenience of teachers and pupils. Nine locker rooms, with 1,000 steel lockers; bicycle room for 400 bicycles; gymnasium, 90 ft. x 48 ft., with complete modern equipment; swimming pool, 50 ft. x 25 ft.,

The laboratories and shops, in which our readers are more directly interested, are mostly situated in the basement or Floor A, the principal exception being the chemical laboratories, which, for obvious reasons, are located in the upper floor.



TYPICAL CLASS ROOM.

PHYSICS LABORATORY.

the geographical centre of the city, and two main car lines, within a minute's walk, render it easy of access from all parts of the city.

The appearance of the building is decidedly imposing, the style of architecture being of Gothic character, while the exterior is of local limestone laid upon Scotch rubble masonry.

Three of the principal architectural features of the building are—the principal's office, which is also used as a board room, the library, and the auditorium, views of which are reproduced.

The auditorium is 80 feet broad and 90 feet long, consisting of a main floor and gallery. It has a seating capacity of almost thirteen hundred persons.

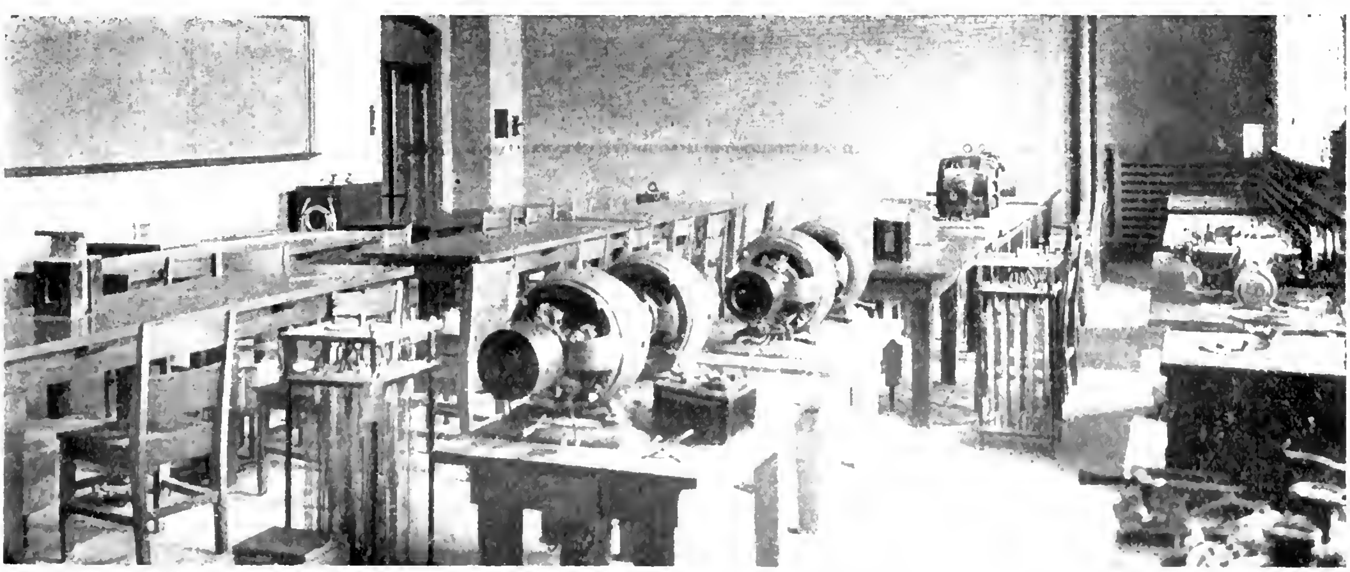
twenty-four showers, and forty dressing rooms, indicate to some extent the completeness of equipment in this respect. The provision of individual steel lockers is in line with the best modern practice, from the point of safety as well as hygiene. In common with most of the efficiency features of the building, these lockers were made in Canada, being the standard product of the Dennis Wire & Iron Works Co.

Thirty standard class rooms are provided, all being fitted with individual desks or tables and movable chairs. Cloak rooms, toilet rooms and assembly rooms, with the necessary offices, complete the equipment features of the institution.

Studies and Equipment

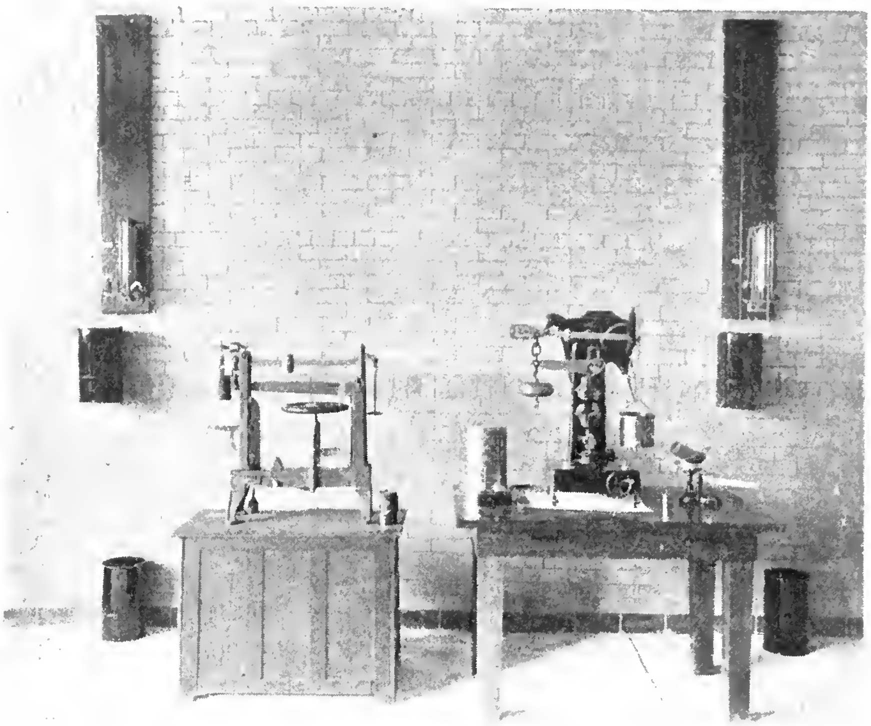
THE industrial course for boys and young men extends over a period of four years, and is designed to prepare them for the pursuits of industrial and commercial life. In general outline it is similar to the matriculation course, except that the latter portion is devoted to the attainment of practical knowledge and personal skill in the branch of industry which the student intends to follow; while in the matriculation course, the studies are directed to qualify the student for further intellectual development in the university.

The subjects covered by the industrial course include mathematics, physics, chemistry, mechanical drawing, freehand



DYNAMO AND MOTOR LABORATORY IN DEPARTMENT OF PHYSICS. COMPLETE EQUIPMENT IS INSTALLED FOR DEMONSTRATION AND EXPERIMENTAL WORK.

drawing, shop work, English, drill, gymnastic and swimming exercises; these studies being supplemented in the last year by such special subjects as geology



GROUP OF TESTING MACHINES IN APPLIED MECHANICS LABORATORY, DEPARTMENT OF PHYSICS.

and mineralogy, steam engine and power plant, architecture and building construction, estimating, clay modeling, printing — practical composition and press work; practical painting and decorating, metallurgy and assaying, and electro chemistry.

Of chief interest to engineers is the equipment provided for the study of physics, shop work, engineering and chemistry. These four subjects are of prime importance to the technical student, and the school authorities have shown their recognition of this fact in the liberal equipment provided for the study of these subjects.

Physical Laboratories

The study of physics forms part of all branches of the industrial course. It commences during the first year with electricity and magnetism, fluids and heat, with developments later in mechanics, heat, light, etc.

Four physical laboratories are provided on the main floor, two being equipped for general physics and two for special work in electricity and light. These rooms are all provided with special low-voltage direct currents, as well as with the usual alternating and direct currents.

Dynamo and Motor Laboratory

On the lower floor are installed the dynamo and motor laboratory and the applied mechanics laboratory. Amongst the principal articles of equipment in the former room are a Westinghouse testing transformer of 5 k.v.a. capacity, taking 110 volts primary, and providing 25-cycle secondary in steps of 200 volts up to a maximum of 12,000 volts; this apparatus is conveniently mounted on wheels so as to be available at any desired point; five ordinary transformers; two Westinghouse induction motors, both 5 horse-power, 3-phase machines for 25 and 60-cycle, 110 volt current respectively; one Swedish General Electric a.c. motor generator set, for 1, 2, and 3-phase alternating current, consisting of a 35 horse-power d.c. motor for 220 volts and 1,200 revs. per minute, and a generator having a capacity of 25 k.v.a., 60 cycles. It is arranged to deliver 116 amperes of 3-phase current at 125 volts, or 199 amperes at 72.5 volts, the 2-phase current being 119 amperes at 105 volts; two d.c. motor generator sets, by General Electric Co., are of 5 horse-power, having shunt wound motors running at 1,400 revs. per min., with 115 volts. A number of small motors and dynamos, of various types and sizes, are used for demonstrating principles of construction and design, while ample numbers of instruments are available for individual students. Three trenches run the full length of this room, and provide junction boxes for each table.

Applied Mechanics Laboratory

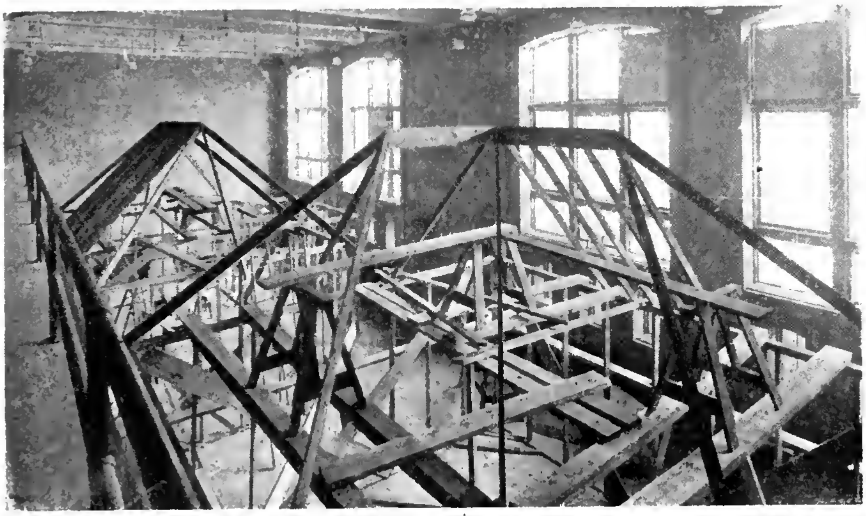
Connected with the dynamo and motor laboratory is the applied mechanics laboratory. The equipment of this laboratory includes an Olsen 30,000-lb. testing machine for tensile, transverse and compressive tests; one Olsen machine of 4,000 lbs. maximum load, for transverse tests only; a 300,000-lb. machine for compressive and transverse tests on brick and cement blocks; one Fairbanks tensile machine of 2,000 lbs. capacity and other appliances for cement testing; three Barr autographic recorders of stress-strain diagrams; various types of chain blocks, spring scales, etc., and ample equipment for the individual performance by the students of all minor experiments and tests.

During the third and fourth years the laboratory work in physics is strongly emphasized, and experimental work is carried on to a considerable extent, as shown by the following outline of the work. Third year electricity: dynamo

DEPARTMENT OF SHOPWORK. VIEW OF MILL ROOM IN WHICH LUMBER IS DRESSED AND CUT TO SIZE FOR USE IN WOODWORKING SHOPS.

and motor design, measurements and calculations of temperature rise of machines, efficiency tests, magneto motive force, magnetic flux and permeability, capacity of storage batteries, power and efficiency of lamps. Fourth year electricity: measurements and calculations of brake horse-power, insulation resistance and capacity of lines and condensers, magnetic flux and leakage in dynamo circuit, etc.; single and polyphase alternating currents, efficiency of transformers, induction and synchronous motors, etc.

In applied mechanics, the training is equally as thorough and complete, the same period covering the investigation of friction in various forms of mechanism, such as worm gears, jacks, pulley blocks, etc.; strength of materials, joints, properties of beams, columns, etc.; stresses in roofs and bridges, foundation work and reinforced concrete; also the flow of air, steam, and water in pipes, principles of fans, etc.



DEPARTMENT OF SHOPWORK. VIEW OF THE CONSTRUCTION ROOM WHERE STUDENTS IN THE BUILDING TRADES TEST THEIR SKILL ON A LARGE SCALE.

Department of Shop Work

THE value of a thorough training in shop work has long been recognized by the authorities, and the former equipment has been greatly enlarged and modernized to accord with present-day developments of machines and apparatus.

There are seven rooms devoted to instruction in woodworking alone, viz., two elementary shops, two pattern shops, one cabinet shop, one carpentry shop and one mill room. In addition to these, there is a construction room, 80 feet long, 37 feet wide, and 30 feet high, affording ample space for the erection of two moderate-sized dwelling houses at one time. Here the students of various trades are afforded facilities for performing their work under actual every-day conditions. Carpenters erect the framing, assemble interior finish, etc.; plasterers perform their work on selected parts of the building; paperhangers, wiremen, gasfitters and plumbers all receive opportunity for testing their ability to carry out the work of the various trades involved.

The equipment of the wood-working shops, where the various branches receive instruction, is very ample, and no expense has been spared to make the teaching truly individual. In each of the elementary woodworking shops there are six lathes, a trimmer, a mortiser, a jointer, a power saw, a tool grinder, and twenty-four benches with the usual small tools. One of the pattern shops has eleven lathes, trimmer, jointer, etc., and twenty benches. The other contains one 20-inch motor head block pattern-making lathe, with power feed, six 12-inch motor head block lathes, one band saw, one universal saw table, a jointer, a disc and spindle sander, a trimmer, twenty benches and small tools. The cabinet shop and carpentry shop are suitably equipped, while the mill room is furnished with a 30-inch cabinet surfacer, a 16-inch jointer, a rolling table cut-off saw, a self-feed rip saw, a band saw, a belt sander, a shaper, and a drying room, 11 ft. x 18 ft. x 14 ft.

Iron Working Shops

A foundry, forge and machine shop are equipped to provide individual instruction to students in classes of about twenty. The foundry is a lofty room, 57 ft. x 30 ft., containing a cupola, three brass furnaces, one core oven, a pneumatic rammer, moulding machines, a ladle heater, flasks and small tools. The photograph, reproduced on page 607, gives a good impression of the ideal conditions under which foundry students work. Comfortable, clean, well ventilated and well lighted surroundings, with the best of material and apparatus, enable the student to concentrate his attention entirely on the work. A row of wash bowls is installed on the gallery so that students may leave their work in comfort.

The work of the foundry class in the early stages consists of instruction in preparing simple molds and cores, followed by a study of the various materials, sands, binders, etc. As the work progresses in the other shops, more intricate patterns are received, while the use of molding machines and cupola charging are gradually introduced into the work. The preparation of brass castings, and work in non-ferrous alloys is also included in the regular work at later stages.

Forge

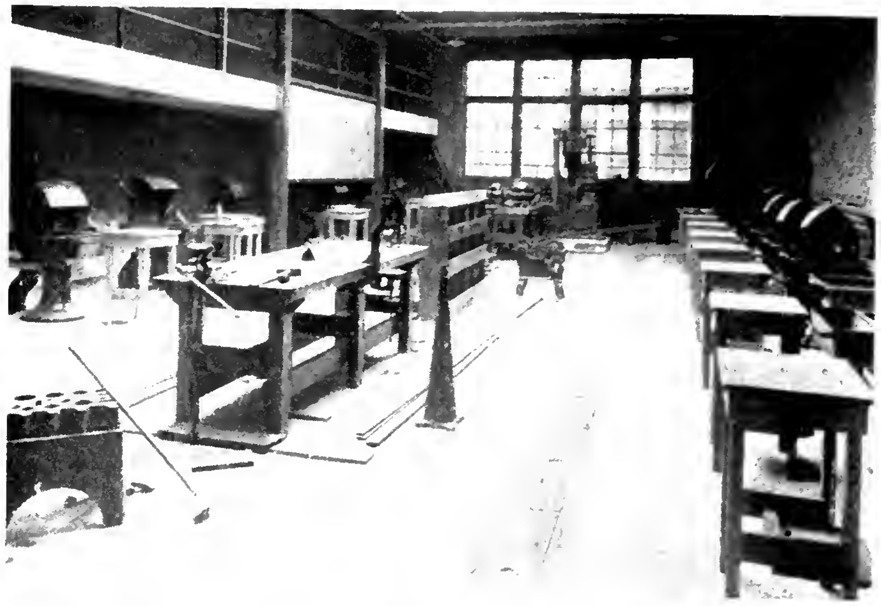
The equipment of the forge is representative of modern methods, including as it does twenty "Buffalo" down-draft

DEPARTMENT OF SHOPWORK. VIEW OF ELEMENTARY WOODWORK CLASS ROOM IN WHICH STUDENTS ARE TAUGHT TO HANDLE AND PERFORM SIMPLE MACHINE WORK.

forges, a gas heating forge and a gas-hardening furnace.

A complete Bristol pyrometer installation enables the effects of heat treatment to be fully investigated, the evils of careless heating being demonstrated in an impressive manner. The forging of tools for the machine shop, the making of dimensioned forgings, welding, hardening, tempering, etc., are a few of the activities pertaining to this department.

A hand lever shearing machine, and a medium size power hammer remove much of the physical effort from the work, and allow the student's time to be fully occupied in learning useful work rather than spending much of it in more or less useless exertion which is of no instructive value to him.



DEPARTMENT OF SHOPWORK. VIEW OF FORGE ROOM SHOWING SMITH'S HEARTHS, WITH POWER HAMMER AND HARDENING FURNACES IN BACKGROUND.

Machine Shop

The machine shop is 57 feet x 57 feet, and contains an ample equipment of plain engine lathes, with various other machines by representative makers. The room is light and airy. It is situated on the basement, and being in a court or well, it has been possible to provide ample daylight from the roof and also one side. Artificial lighting is very well taken care of by semi-indirect nitro-tungsten lamps.

Five motor driven tool-room lathes are installed. These are all driven by individual motors, the control systems used being General Electric and E. C. & M. Co. These lathes are fitted with taper and relieving attachments, and are well calculated to afford advanced pupils every facility for performing all operations likely to be encountered in everyday work. The makers of these machines are Reed-Prentice Co., Flather & Co., Lodge & Shipley Machine Tool Co., R. K. LeBlond Machine Tool Co., and W. P. Davis Machine Co.

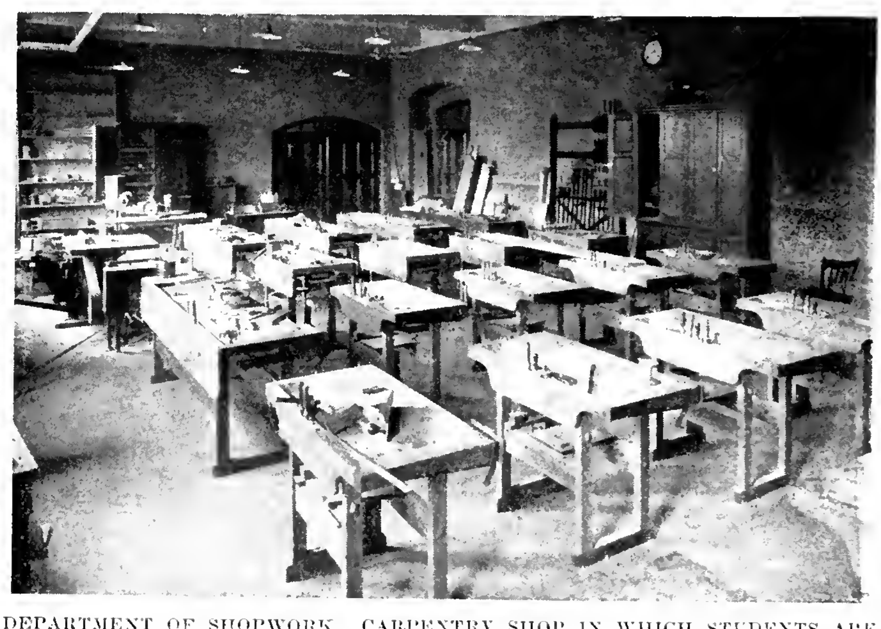
DEPARTMENT OF SHOPWORK. GROUP OF MOTOR HEAD WOODTURNING LATHES IN PATTERNMAKING SHOP.

Sixteen plain engine lathes of 14 in. capacity made by the Canada Machinery Corporation, are installed for class instruction in lathe work.

Milling machines include a motor driven No. 2 Cincinnati Plain Miller, one No. 1½ Brown & Sharpe Plain Miller, and two small universal Hendey machines.

A full equipment of shaping machines is provided including two "R. A. Kelly," one "Gould & Eberhardt," and one "R. McDougall." Other notable machines include one 26 in. x 26 in. x 6 ft. Bertram planer, with variable speed and reversing motor drive; one 10 in. x 36 in. plain Landis grinder; one Modern plain grinder; one universal and one cutter grinder by the Cincinnati Milling Machine Co.

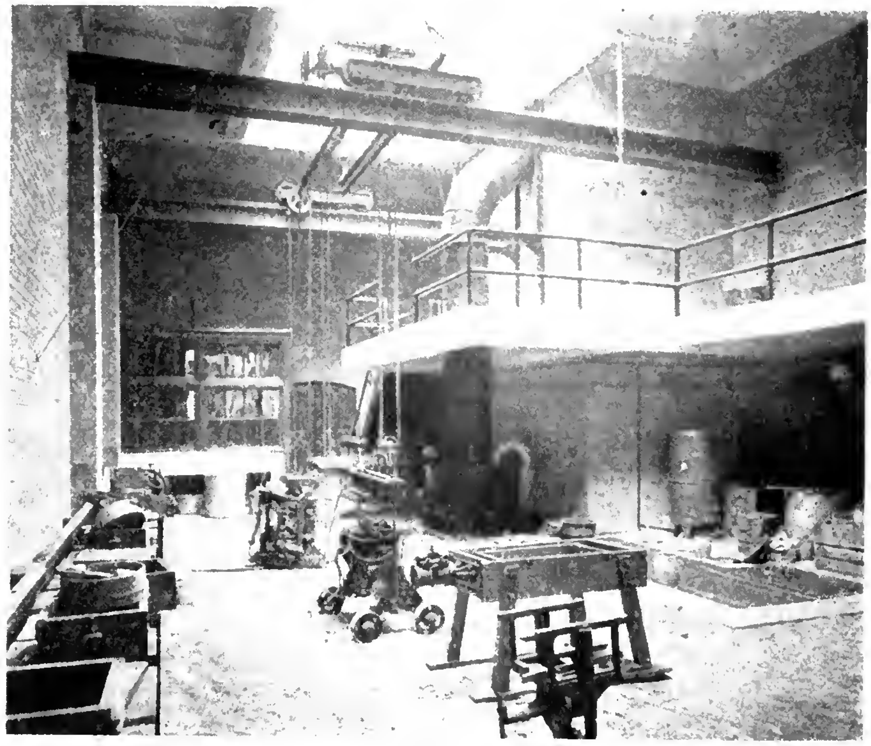
A No. 1 Colburn 12-inch heavy duty drill with individual motor and E. C. &



DEPARTMENT OF SHOPWORK. CARPENTRY SHOP IN WHICH STUDENTS ARE TRAINED TO BECOME EXPERT IN MANUAL WORK.

M. control; one Garvin die slotter; one C. M. C. power press and various accessory tools complete the equipment. All of the motor driven tools have Westinghouse motors, while ample bench capacity is provided for twenty students.

A feature of the small tool equipment is the provision of tool sets in individual racks, which is in accordance with most efficient shop practice.



DEPARTMENT OF SHOPWORK. VIEW OF FOUNDRY SHOWING CUPOLA, BRASS FURNACES, MOULDING MACHINES, AND WORK BENCH.

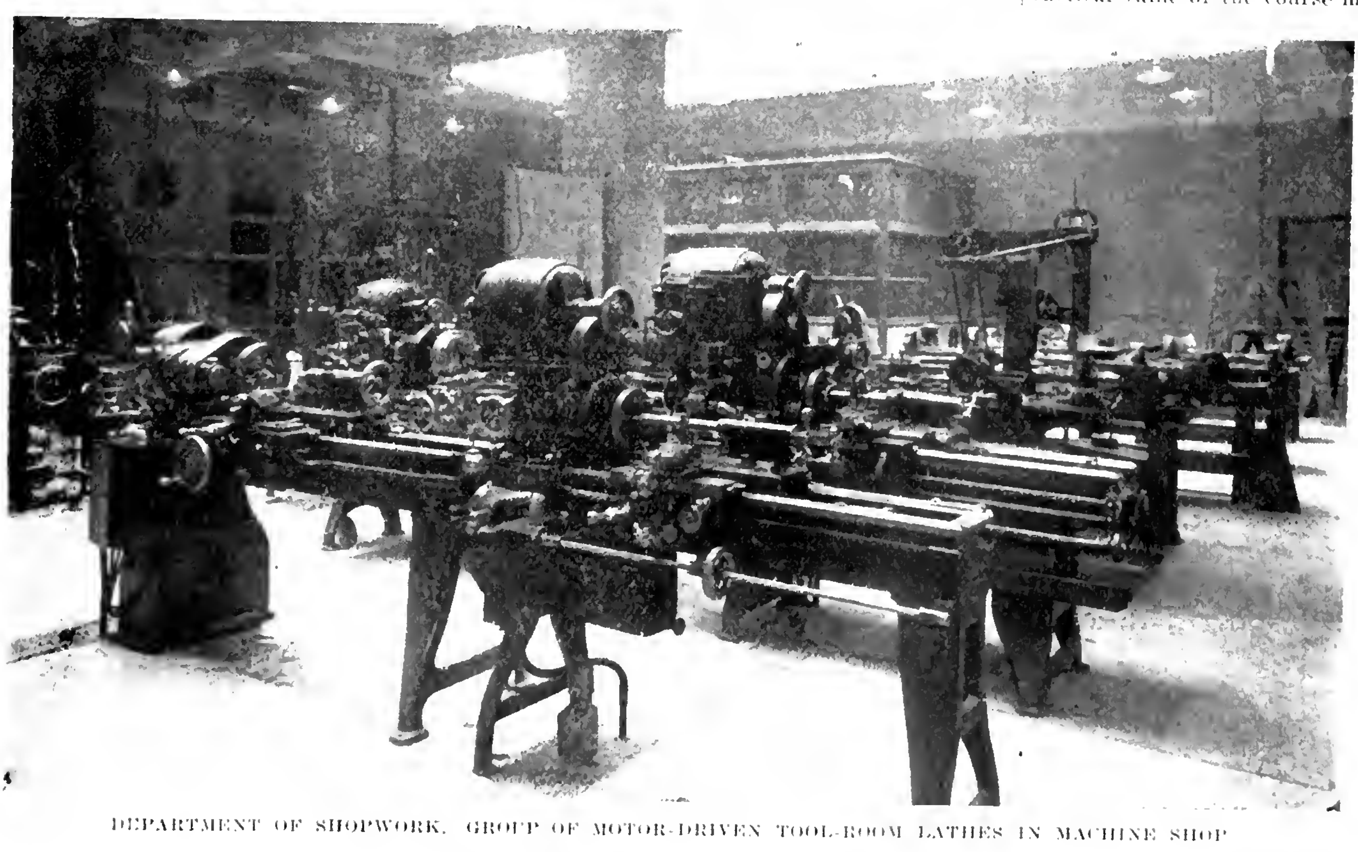
Printing Shop

Next to the machine shop equipment, that of the printing shop calls for comment. The great extent to which the art of printing contributes to the enjoyment of modern life, and facilitates the advancement of civilization in all parts of the world, is not always realized by the general public, probably because as the old saying puts it, "familiarity breeds indifference." and the ordinary newspaper is the most familiar object in these days. While newspaper work represents the more spectacular development of printing, the general publishing business employs thousands of persons whose ranks are being increased yearly.

Years ago conditions were such that at least some definite attention and instructions could be given beginners in the printing trade, and by the time apprentice days were over, the boy usually had acquired a good general working knowledge of the trade. On the other hand, the extensive improvements made in the operation of the printing business during the past decade, the tendency toward individual specialization, and other factors have limited the apprentice's opportunities for acquiring a knowledge of the craft.

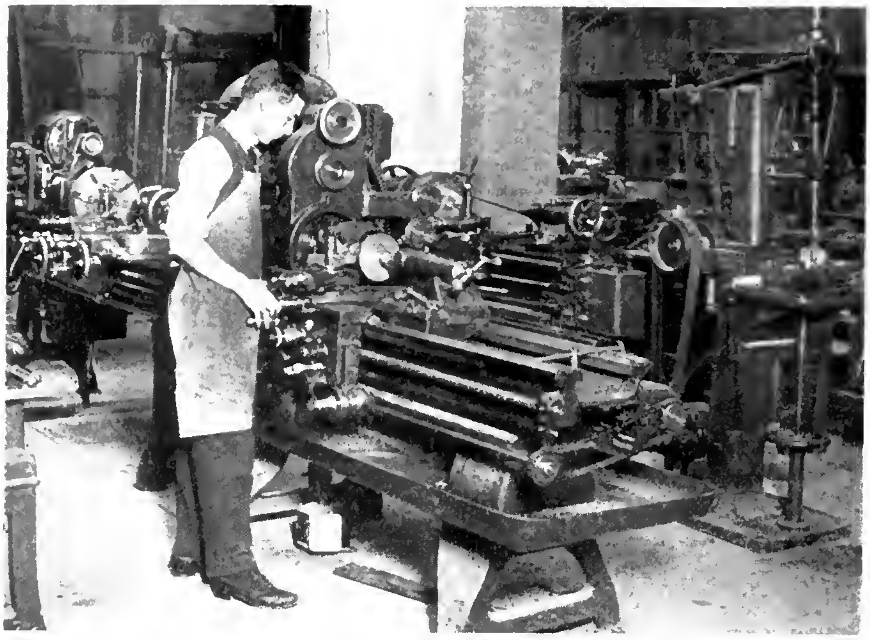
Three years ago the Toronto Board of Education took steps to assist the printer to secure this supply of human material by opening the Apprentices' School of Printing as a department of the Toronto Technical School. Their aim was not to relieve the printer of all responsibility so far as apprentices were concerned. Rather was it to accelerate the efforts of the printer and place at his disposal means whereby apprentices working at the trade can for certain periods of the week be under the personal guidance of a practical teacher.

A carefully selected equipment costing upwards of $15,000 has been placed at the disposal of the classes, and an idea of the practical value of the course may



DEPARTMENT OF SHOPWORK. GROUP OF MOTOR-DRIVEN TOOL-ROOM LATHES IN MACHINE SHOP

be gained from the rough summary of the lessons as follows: Practical work includes learning the case, setting of straight matter, tabular matter, letter-heads, billheads, menus, programs, title pages, advertisements, etc.; imposition of four, eight, twelve, sixteen, twenty-four and thirty-two page forms; folding machine work, platen and cylinder press work and make-ready are also included in this course.



DEPARTMENT OF SHOPWORK. ONE OF THE ELECTRICALLY OPERATED LATHES IN MACHINE SHOP ON WHICH STUDENTS PERFORM INTRICATE OPERATIONS.

Free-hand drawing and lettering design and harmony, and a section on English complete the curriculum.

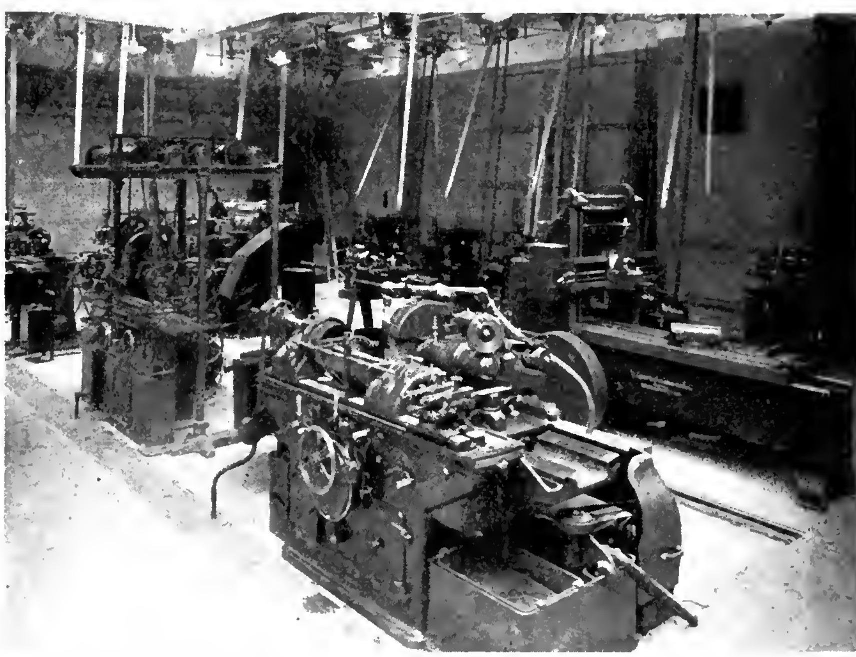
The composing room is 48 ft. x 33 ft. with large window areas on the north and west. It is equipped with thirteen Tracey cabinets, eighteen type racks, and a large steel top imposing stone.

The press room is 56 ft. x 28 ft., and contains a No. 3 Miehle press, a Colts Armory press, a Phoenix press, a 38 in. automatic power paper cutter, a hand paper cutter, a folding machine, and two wire stitchers.

Building Trades

Included in the above category are shops devoted to instruction in Plumbing and Steamfitting, Electrical Construction; Brickmaking and Bricklaying: Cement and Stone Work, and Plaster Decoration.

Through the kindness of interested firms, the brick department is equipped with a pug mill, a soft-mud machine and a stiff-mud machine, the latter having a wire cut table. The other trades mentioned are well taken care of so far as instruction and equipment is concerned, all modern tools and apparatus being on hand. The final test, of course, is trying out the students under practical conditions, and it is in connection with this that the value of the construction room becomes so evident. The present stage of construction includes the erection of frame dwellings and each of the building trades classes is afforded opportunity of carrying out the work under actual house-building conditions. Plumbing, wiring, plastering, wallpapering and all decoration work is performed on a suitable scale so that maximum instruction is given on each subject.



DEPARTMENT OF SHOPWORK. VIEW OF MACHINE SHOP, SHOWING GRINDING MACHINES, REVERSING MOTOR PLANING MACHINE, AND SHAPERS IN BACKGROUND.

In the near future it is intended to make a more complete effort in which the work will be a two-storeyed brick building, the bricks being made in the school shop and laid by the school class.

Architecture and Design

The theoretical side of building and machine work is well taken care. Four class rooms are assigned to the architectural classes and four to the mechanical classes. One of the former, devoted to the teaching of elementary architecture, contains forty-five individual drafting tables. The mechanical rooms are also furnished with individual tables, all of the rooms being provided with a universal blackboard drafting machine. Blueprint rooms are situated on the roof of the building and are equipped with a continuous printing machine, while frames for sun printing are also supplied.

Department of Chemistry

THE chemical department includes seven distinct laboratories for the following special purposes, viz.: Elementary Chemistry, having working accommodation for sixty students and locker accommodation for five hundred students; Industrial Chemistry, provided with three fume closets, working tables and lockers for forty students, and special apparatus for various trades; Qualitative Chemistry, fitted up with special drafts, and a large fume closet for the hydrogen sulphide generator. There are working places for forty students; Qualitative Chemistry, accommodating forty students and provided with fume closets, D.C. and A.C. current, compressed air, steam and drying ovens; Electroplating, provided with a motor-generator to produce low voltage currents suitable for electroplating, ammeters, voltmeters, tanks, etc.; Metallurgy, furnished with

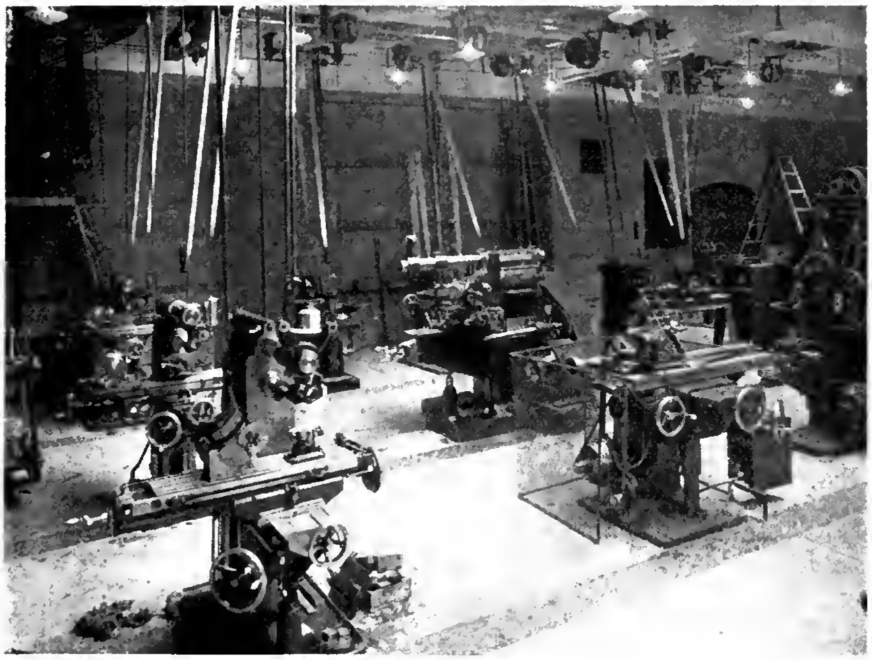
various types of furnaces for use in assaying and the study of metallurgical operations; Photography and Photo-engraving, consisting of a large dark-room with working space for twenty students. Individual sinks with ventilating hoods and ruby lights, and a smaller dark cabinet are features of the equipment.

A feature of the work of the department is the provision of special evening trades classes for workmen who desire to obtain instruction in specially advanced or peculiar applications which they have no opportunity of studying during their regular work.

Electro-plating and dye-work are two of the industries which are receiving special attention in this manner, and it is intended in the near future to either investigate special problems for such manufacturers as desire it, or arrange to place the equipment at their disposal. In this way the work of the department will gradually come more into contact with actual commercial work, and the judicious direction of students' energies may well ultimately result in the general advancement of the various industries concerned, not so much through special assistance on specific cases, as in the increased skill and knowledge of the operatives.

Work in geology and mineralogy is provided for those who are interested in the application of the earth's products to industry and art, and for all who may be interested in the pure sciences.

The importance of chemistry in household work is not overlooked, and it occupies a suitable place in the course of Domestic Science for young women.



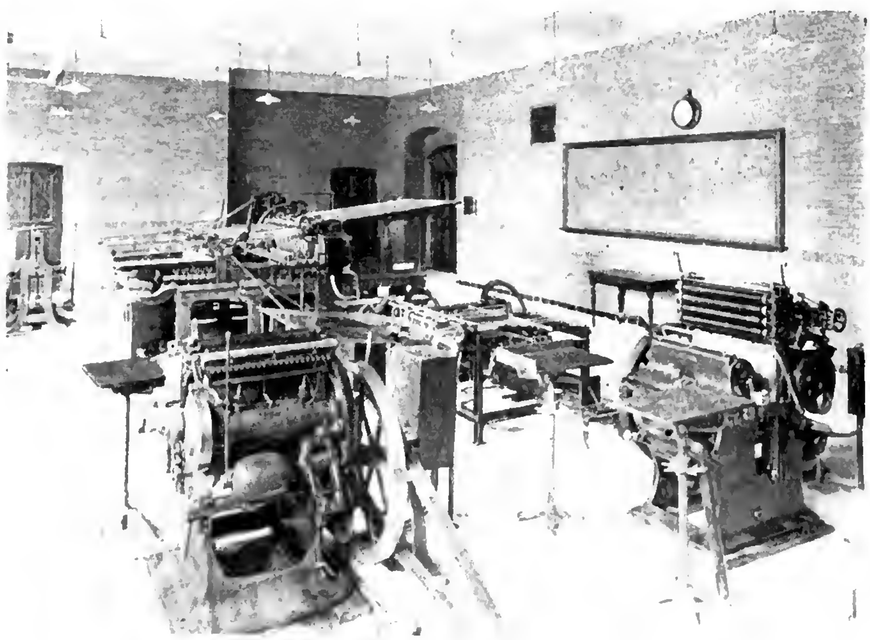
DEPARTMENT OF SHOPWORK. GROUP OF MILLING MACHINES IN MACHINE SHOP.

Power, Light and Heat

THE engineering department of the new Toronto Technical School comprises the entire power plant, heating and ventilating system, air compressor plant, refrigeration plant, elevators, hot water service system, the various auxiliaries and the experimental engine laboratory. The engineering department is one of the most important in any technical school and in this case no expense has been spared in getting the best equipment and installing it to the best possible advantage to meet the requirements of an institution of the kind. The power plant, for instance, in addition to furnishing light, heat, etc., for the building, can also be turned to good account for the benefit of the students, although primarily it is intended for the former service.

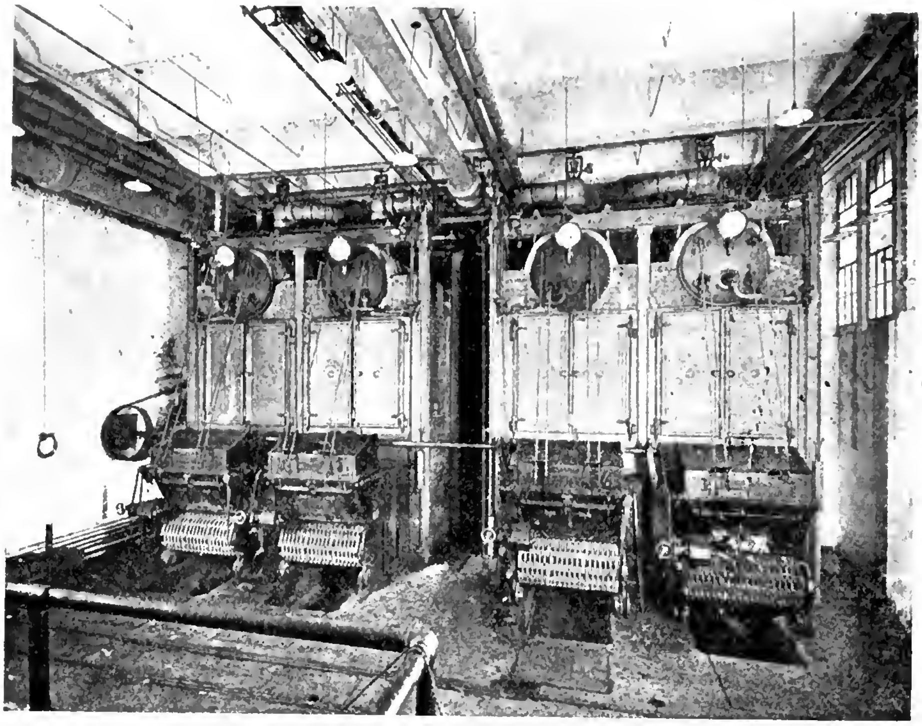
The various requirements that had to be considered in the layout of the plant may be briefly summarized as follows: To provide light, heat and power for both day and night use independent of outside power, but at the same time to operate in conjunction with it if necessary; to include in the plant such an assortment of equipment and apparatus as to give the student an opportunity of familiarizing himself with various makes and designs which he might encounter in his future career; to distribute and supply electricity, compressed air, hot and cold water, to all the shops and laboratories for the benefit of the students; to provide good heating and ventilation and an adequate supply of hot and cold water for the lavatories and swimming tank; to have a plant that could be used for demonstration purposes for students, and at the same time used for ordinary purposes without any loss of efficiency.

The power plant is located in the sub-basement 25 feet below the basement floor, and 30 feet below the street level. The sub-basement floor is 16 feet below the sewer, and is divided into three main sections, boiler room, engine room and fan room. The boiler room is again subdivided to form the pump room at a slightly higher level. In the boiler room in addition to the boilers are the sump pit, coal bunkers and blow-down tanks.



COMPOSING AND PRESS ROOM, WHERE STUDENTS ARE TAUGHT THE VARIOUS BRANCHES OF PRINTING

In the pump room are the boiler-feed pumps, circulating pumps on the heating system, feed water heater, live and exhaust steam heaters, service water heater, swimming pool water heater, and filter.



WATER TUBE BOILER INSTALLATION.

The engine room contains a large high-speed engine and generator, a horizontal high-speed unit, a horizontal "Corliss" engine and generator, air compressor, ammonia compressor and motor generator set. On the gallery is the switchboard, while on the same level, but outside the engine room are the operating engineers' room, locker and lunch room for the firemen, several store-rooms shower bath and lavatory. In a small room off the engine room and at the same level is a transformer room and also the refrigerator room containing a tank for making can ice, also drinking water chill and filter. In the fan room are two large ventilating fans with air washers and heaters, a smaller fan for the smith-shop forges, vacuum machine for the chemical and physical laboratories, a vacuum cleaning machine, and temperature regulator equipment. On this floor leading to the fans is a large cold air intake 10 feet high by 25 feet wide.

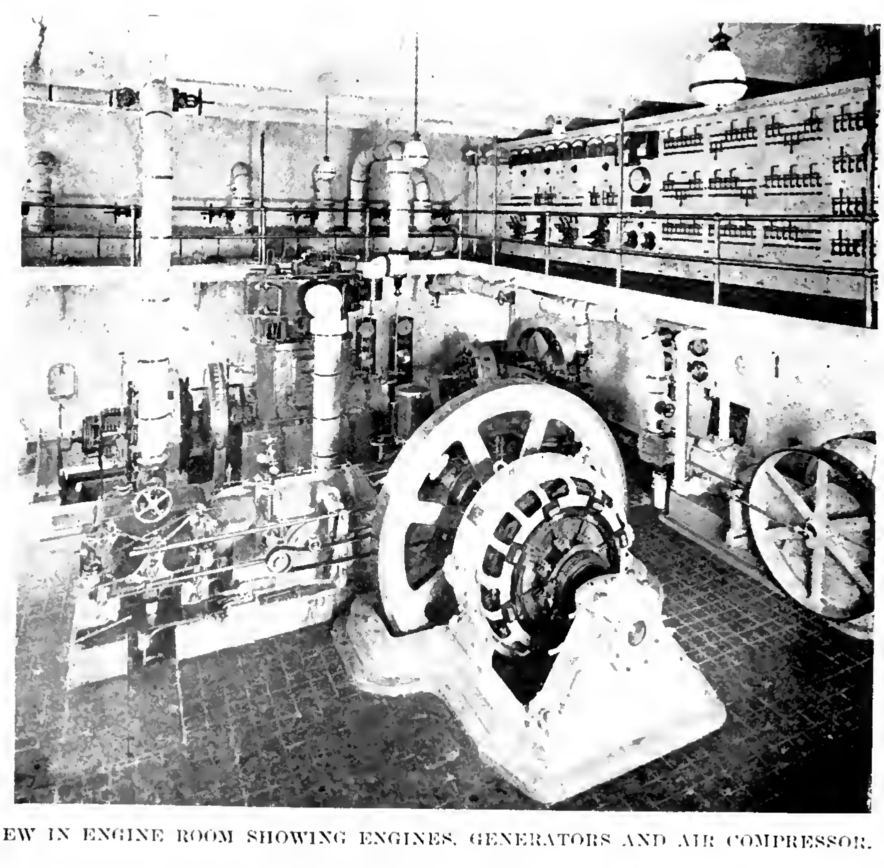
Boiler Installation

The boiler plant consists of four water-tube boilers, arranged in two batteries and having a total horse-power of 720. Each boiler is rated at 180 horse-power, and has a heating surface of 1790 sq. feet. The tubes are 4 in. in diameter and 18 ft. long, arranged in 8-sections wide, and 10-tubes high. Each boiler has one steam drum 42 in. diameter. The boilers are of standard forged steel construction and are built for a working pressure of 200 pounds, but are operated at 150 pounds per sq. inch. They are fitted with superheaters to give 100 to 120 degrees Fahr., and have chain-grate stokers each having a grate area of 35 sq. ft. The boilers and chain-grates were built and installed by the Babcock & Wilcox Co., Montreal and Toronto.

The boilers are suspended from steel girders resting on steel columns on cast iron bases. The flue dampers are operated by hand. The boilers are fitted with B. & W. type mixing valves, by which the temperature of the superheated steam may be controlled. They are also fitted with standard thermometer wells in superheat box. Auxiliary wells are installed in the steam line with steel mercury thermometers having gauges in front of the boiler giving reading of steam and superheat. Each boiler has two 2½-in. McAvity pop safety valves, one 12-in. brass cased steam gauge, one "Turnbull" high and low water alarm, two ¾-in. water gauges fitted with automatic closing valves, one 2-in. diameter stop and check valve, one 2-in. diameter stop valve, etc.

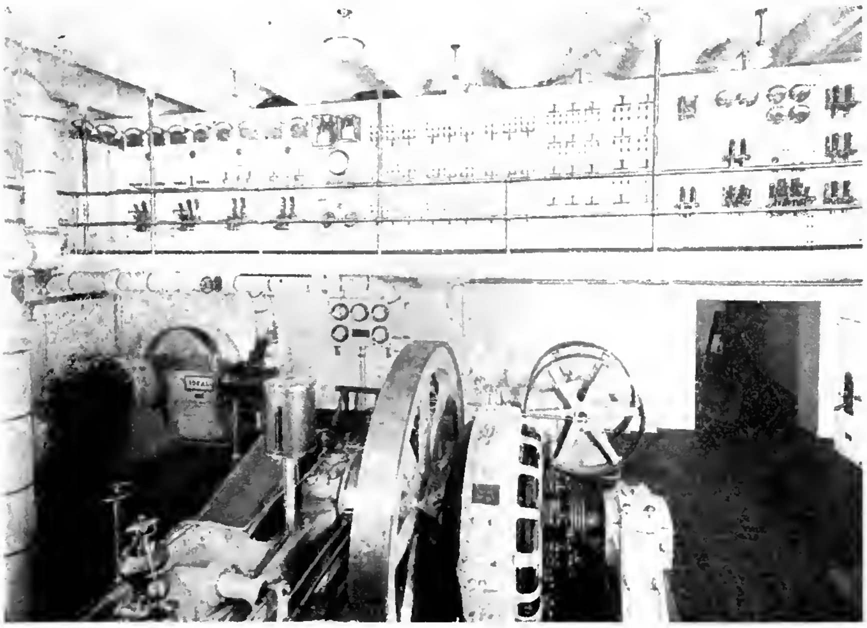
Coal is fed to the grates through hoppers in front of the boilers. Each hopper is provided with a valve for shutting off the supply of coal to the fire and thus controlling the depth of the latter. Doors are provided at the front of the hoppers for hand firing. The stokers are operated by a standard B. & W. vertical enclosed 5½-in. x 5-in. engine, and the coal is carried to the hoppers in a car running on tracks and having a capacity of 1,000 pounds. The coal bunkers are at the side of the boiler room under the sidewalk level. The coal is weighed on a "Dormant" warehouse scale having a capacity of 2,500 pounds and supplied by the Canadian Fairbanks-Morse Co.

Two duplex 7½-in. x 5-in. x 6-in. outside packed plunger pumps, fitted with pot valves, are installed for feeding the



VIEW IN ENGINE ROOM SHOWING ENGINES, GENERATORS AND AIR COMPRESSOR.

boilers. The pumps take water from the "Cochrane" heater to the boilers, and were supplied by the Smart-Turner Co., Hamilton, Ont. For emergency use there is installed a "Metropolitan" injector, single level pattern. The injector is fitted with a by-pass, so that city water can be used direct.



ANOTHER VIEW IN ENGINE ROOM SHOWING HORIZONTAL CORLISS ENGINE AND GENERATOR IN FOREGROUND.

The "Cochrane" feed-water heater is rated at 750 h.p., its exhaust inlet and outlet being 12 in. diameter. The heater is fitted with five gravity return connections from exhaust steam heating system. It has a 6-in. connection for boiler feed and a 3-in. connection for discharging from traps. A pump and receiver are installed for collecting condensate from the live steam heater and returning same to the boilers. The pump is a 6-in. x 4-in. x 7-in. duplex type of "Smart-Turner" make. The outfit is equipped with a "Waters" type of governor valve and float, and water at 250 degrees can be handled. Two "Davis" 5 in. automatic stop and check-valves are fitted in the steam headers, one for the main engines and one for the auxiliary units.

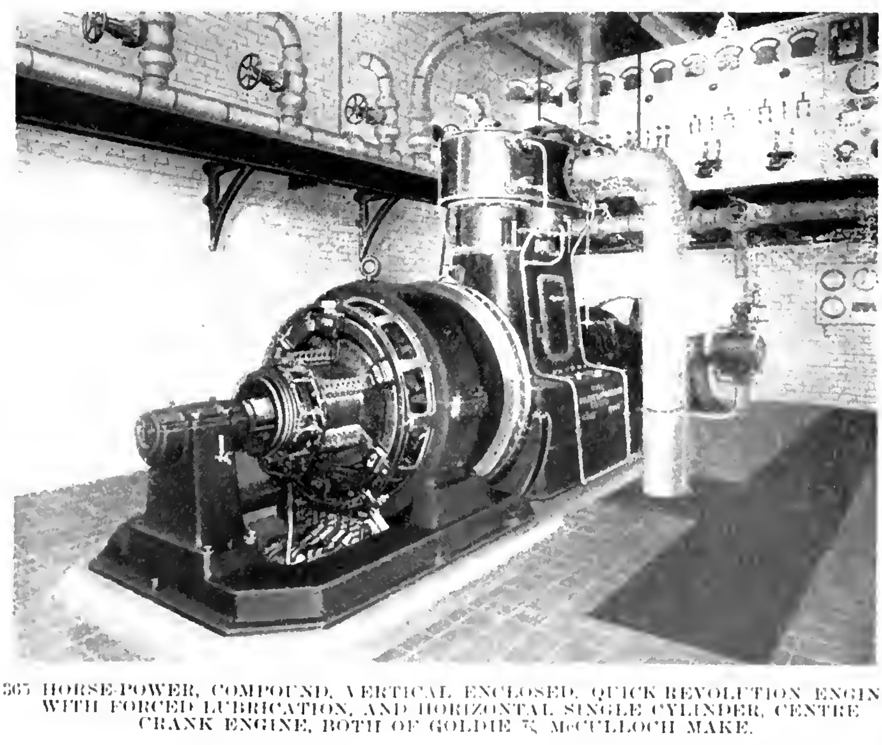
The boiler blow-down tank is located at the rear of the boilers. It is 36 in. in diameter and 48 in. deep, with a 4-in. connection to the boilers and also to the sewer. A 4-in. vapor tube is connected to the tank. This tube leads from the exhaust pipe and allows the steam or vapor to go from the tank to the heating system and also drains water from the steam-line. The exhaust steam main is 12 in. diameter and the main water-line for the heating system is 10 in. diameter.

There are a number of steam traps installed; one "Davis" trap drains the steam headers and all steam heating coils for laundry and dry kilns. A "Davis" trap is also fitted to the service water heater, and the steam connections in the chemistry and physics laboratories are fitted with similar traps. The swimming pool heater is fitted with a trap. All high-pressure traps discharge to the feed water heater, and the exhaust pipe traps discharge to the sump through the blow-off tank.

Engine Room

The engine room has a bright and attractive appearance, the area occupied being 43 feet by 40 feet, and height of ceiling 20 feet. The flooring is of red Welsh tiling, and the side walls of white tile with white enamel finish above; a large mezzanine balcony accommodates the switchboard, and quarters for the engineers lead from same. The units installed are of different types and were selected to show the students the various kinds of machines in use at the present time. The steam plant is more than large enough to develop the necessary power for the motors and lighting systems, etc., but a very favorable rate was obtained from the Toronto Hydro-Electric Commission, so power from this source is largely used. The fact that the plant is larger than absolutely necessary for the power required is accounted for by the necessity of having the various units for demonstration purposes as well as for the actual development of power for the building.

The largest unit is a high-speed compound vertical enclosed, forced lubrication-engine built by the Goldie & McCulloch Co., Galt, Ont. This engine is rated at 365 h.p., and has cylinders 16 in. and 25 in. diameter, by 10 in. stroke. The governor is of the combined throttling and cut-off type. The engine runs non-condensing and is specially designed for superheated steam. The cranks are set opposite to one another, and the reciprocating parts of the high and low pressure sides are carefully checked so that they weigh exactly the same. This arrangement practically balances the reciprocating parts and eliminates vibration at high rotative speed. The engine is direct connected on a common subbase to a 250 k.w. three-wire d.c., inter-



365 HORSE-POWER, COMPOUND, VERTICAL ENCLOSED, QUICK REVOLUTION ENGINE WITH FORCED LUBRICATION, AND HORIZONTAL SINGLE CYLINDER, CENTRE CRANK ENGINE, BOTH OF GOLDIE & McCULLOCH MAKE.

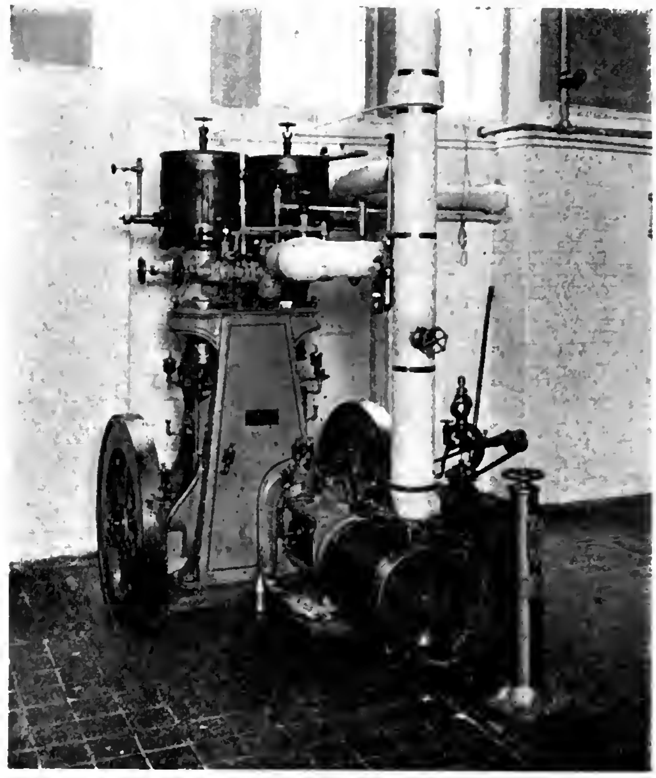
pole generator, built by the Canadian Westinghouse Co.

There is also a horizontal double eccentric Corliss engine built by the John Inglis Co., Toronto, Ont. The engine has steam dash pots, is rated at 150 horsepower, and has a cylinder 12 in. diameter by 24 in. stroke. It is direct connected to a 100 k.w., three-wire interpole d.c. generator built by the Canadian Westinghouse Co., Hamilton. The speed is 150 revolutions per minute. A smaller unit showing a type in common use consists of a single cylinder Goldie & McCulloch centre crank 10 in. x 12 in. "Ideal" engine. This runs under the same steam conditions as the other units and is rated at 75 horse-power, when running at 275 r.p.m. It is of the enclosed type with splash oil system, and is direct connected to a Canadian Westinghouse Co. 50 k.w. three-wire d.c. generator.

For converting hydro a.c. current to d.c., which is used throughout the building, a Canadian Westinghouse Co. motor generator set is installed. This unit consists of a 125 h.p. three-phase 550 volt. induction motor direct connected to a three-wire d.c., 110-230 volt, 3-wire generator with a capacity of 75 k.w., and running at 800 r.p.m. The starting mechanism for the motor generator is of Canadian Westinghouse Co. make, and is mounted on a white marble panel with an oil immersed auto-switch.

Compressed air for the shops and laboratories and for general use about the plant is supplied by an air compressor built by the Canadian Ingersoll Rand Co., Sherbrooke, Que. This compressor is a 10-in. x 10-in. x 14-in. straight line steam driven machine. It delivers 230 cubic ft. of free air per minute at 100 lbs. per sq. inch, when running at 180 r.p.m. The machine is fitted with an automatic regulator which can be adjusted to obtain any desired pressure. An interesting and somewhat unusual purpose this air compressor is put to is for the swimming pool. Air is blown up through the water in the pool, thus aerating it and driving any scum on top to the channel around the side. The air receiver is 36 in. in diameter, and 72 in. high.

An ice machine is installed in connection with the refrigerator in the Domestic Science Department, for making can ice and for chilling the water supply to the drinking fountains. The ammonia machine has a capacity of 12 tons, and was built by the Frick Co., Waynesboro, Pa. It is a vertical two-cylinder machine, and is direct connected to and driven by a single cylinder horizontal steam engine with "Merze" valve gear. Calcium chloride brine is used, being circulated through the system by a centrifugal pump supplied by the Smart-Turner Co., Hamilton, Ont. The water cooling and can ice plants are in a small room adjoining the engine room. The can ice plant has a capacity of 200 pounds at one pumping.


SINGLE-ACTING VERTICAL AMMONIA COMPRESSOR, DIRECT CONNECTED TO HORIZONTAL ENGINE.

Two Venturi meters are installed in the engine room of 3 in. and 10 in. sizes respectively. The former measures the water being used by the boilers and the 10-in. meter measures the water used in the heating system. The majority of the lubricators used in the plant were furnished by the Canadian Detroit Lubricator Co., Walkerville, Ont. The forced feed lubricator on the large Goldie & McCulloch engine was furnished by the McLeod Mfg. Co., Detroit, Mich. The covering for the high pressure pipes was supplied by the Canadian Asbestos Co., Montreal, Que., and is composed of 85 p.c. magnesia, and sectional, in two thickness. Over this is a layer of 8 lb. sheathing paper, and over that again is a covering of 8 oz. canvas. The pipe fittings are covered with 85 p. c. plastic magnesia and the flange joints with removable hinged covers to facilitate inspection. An oil separator is installed in the main exhaust pipe near the "Cochrane" heater.

A 12-in. "Swartwout" exhaust head is fitted to the exhaust stack. It is of cast iron and is fitted with a 2½ in. drain. A 12-in. "Davis" automatic com-

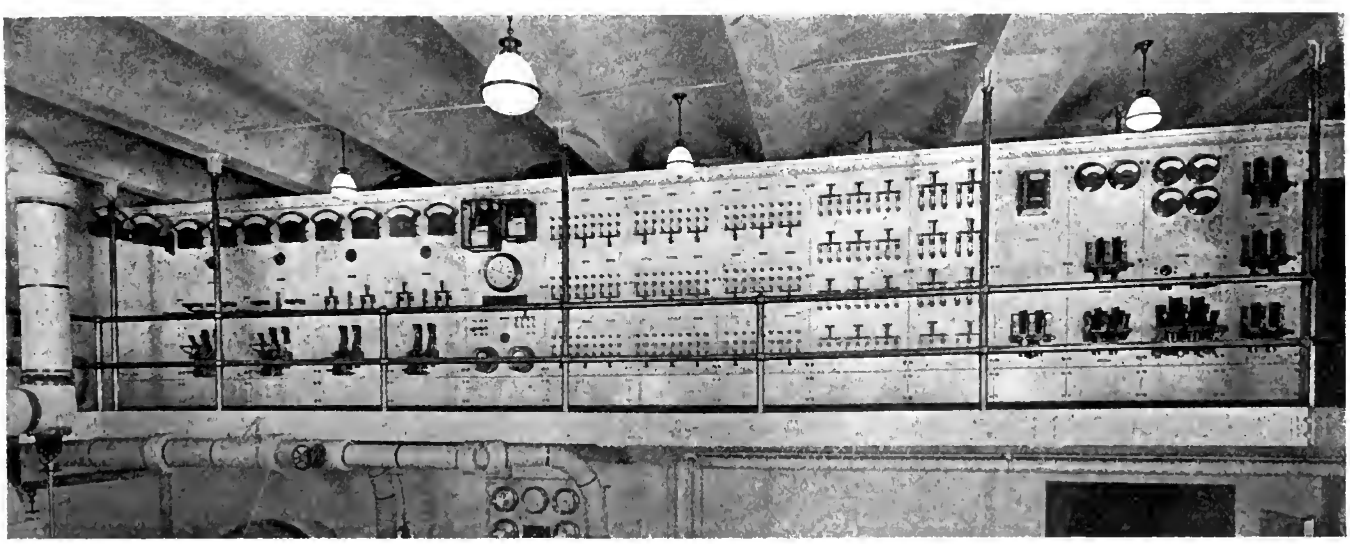

GENERAL VIEW IN PUMP ROOM.

bination back pressure and relief valve is fitted in the base of the exhaust steam stack. A "Simmance-Abdy combustion recorder is installed in the engine room. This apparatus is for testing flue gases and was supplied by the Precision Instrument Co., Detroit, Mich. The steam valves are of "Jenkins," "Chapman," and "Lunkenheimer" make. All the steam and hot water piping was supplied and erected by the General Fire Extinguisher Co., Toronto.

Switchboard

The main switchboard, which is an exceptionally fine piece of work is situated on a balcony along one side of the engine room. It was designed by the Canadian Domestic Engineering Co., Toronto, and installed by Keith's, Ltd., Toronto. The switchboard is 42 feet by 8 feet, and was designed to control 3-engine driven generators, one motor generator set and feeder circuits for light and power, both a.c. and d.c. The system is 120 volts d.c., and 3-wire, 550 volts 3-phase, 25 cycles for the a.c. service and branches.

There are 17 panels, Nos. 1 to 11 being for d.c., and 12 to 16 for a.c. service, and one totalling panel. The panels are made of white Italian marble 2 in. thick, each being built in two sections and supported on an angle iron frame work. There are two sets of bus bars, one carrying the current from the generators which are arranged with equalizer connections so that they can be run in parallel. The other set of bus bars carries the current from the motor generator set serving all the lighting and such power as may be required when the engines are not running. Double throw-switches are installed for this service.



17-PANEL MAIN SWITCHBOARD DESIGNED BY THE CANADIAN DOMESTIC ENGINEERING CO., AND INSTALLED BY KEITH'S, LTD., TORONTO.

There are four generator panels, each being equipped with I.T.E. double pole circuit breakers, a single pole knife switch for the neutral wire and a double pole single throw knife switch for the power wire. Each panel has two "Weston" ammeters and a field rheostat for controlling the voltage of the generators. The totalling panel in the centre of the board has one d.c. graphic recording "Westinghouse" meter for all the generators; one d.c. graphic recording "Westinghouse" watt meter for the motor generator set, and a clock which is connected with the clock system. There is also on this panel an integrating watt-hour meter, also "Westinghouse Columbia" type, 3-wire service for the motor generators. One rotary volt-meter switch is arranged so that the total voltage of any generator can be obtained, or voltage of either outside line and grounded neutral. There are two volt-meters mounted on a swing bracket at the end of the board. One is a single scale instrument connected to the bus bars, and the other a double scale instrument connected to the generators.

There are three light-distributing panels, each having nine triple pole, double throw knife switches. There are also two power-distributing panels. One of the latter has nine single throw triple pole switches and three double throw triple pole switches. The double throw switches control the elevators, machine shop, and some sections of the wood-working shop, so that these can be run by the motor generator or engines. The other power distribution panel has six single throw, triple pole, knife switches and two double throw, triple pole, knife switches.

There are five a.c. service panels. One panel has a three-pole, single throw disconnecting knife switch at the back of the board for controlling the a.c. service. It has also a "Thompson" polyphase meter, and one "I.T.E." circuit breaker. The next a.c. service panel is for the motor generator. It has two "Weston" polyphase watt-meters of 30 k.w. and 100 k.w. respectively, and two "I.T.E." circuit breakers. Another a.c. panel is the frequency changer panel. This has a "Weston" a.c. ammeter, and ammeter receptacles for reading currents in any phase; one "Weston" ammeter for a.c. field; one "Weston" frequency meter, and a "Weston" volt meter. This panel has also a double pole single throw switch with discharge clips and resistance: a rheostat mounting, an eight-point potential receptacle with 4-point plug, and one 3-way ammeter switch on "I.T.E." circuit breaker.

Another a.c. distribution panel has three "I.T.E." circuit breakers. The circuit breakers are used instead of switches for a.c. distribution from the switchboard. All switches are provided with enclosed cartridge fuses, and all current carrying parts are of polished copper.

Heating System

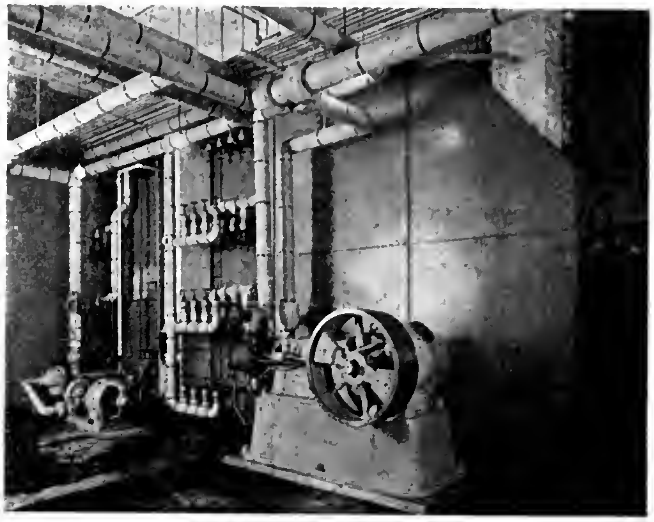
The heating system is an interesting feature of the plant, the principle adopted being hot water heating with forced circulation. The water is first warmed in large heaters and then made to circulate through the radiators by means of centrifugal pumps, afterwards being returned through the heaters with a small loss of temperature. The heaters and pumps are located in the pump room where are also the various return mains all under direct control of the operators. Exhaust steam from the engines and pumps is used in the heater, and afterward returned to the boilers through oil filters.

The exhaust steam heater is 14 ft. 8 in. long overall and 64 in. diameter inside. It is composed of a steel shell, cast iron inlet and outlet chambers, and removable tube cover chamber fitted with a 10 in. nozzle for water connection. The heater contains 1,080 one-

inch brass tubes and has a 2-in. diam. connection. There is in addition a live steam heater which can be used to automatically supplement the exhaust steam as needed. The live steam heater is of a similar construction as the other, but is rather smaller, being 14 ft. 8 in. long over all and 49 in. diameter. It contains 640 one-inch brass tubes and is tested to 200 pounds per sq. inch. The steam passes through, and in passing condenses, transmitting its heat to the water being pumped through the heating system. The heaters were supplied by the General Fire Extinguisher Co.

In this system the temperature of water circulated can be maintained either above or below boiling point, it also can be regulated or controlled at the heaters, thus making it possible to vary the temperature of water to suit climatic conditions. Water can be transmitted any required distance with uniform velocity and small temperature loss. The combined capacity of the heaters is sufficient to carry over 250,-000 feet of radiation.

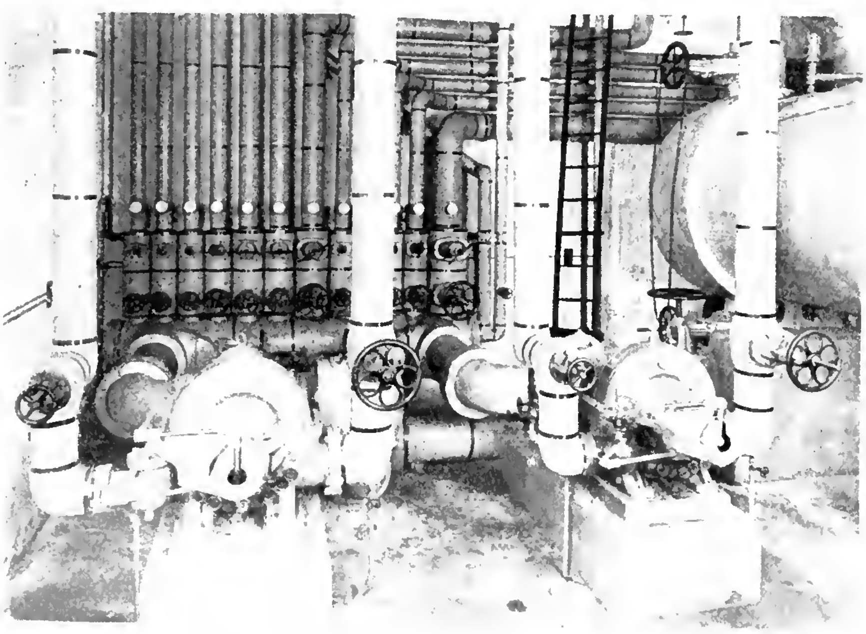
There are two pumps both of the same type for circulating the water through the building. Each pump is of the single stage centrifugal type; having a capacity of 2,100 gallons per minute against a head of 80 feet. The pumps have 10 in. inlet and outlet connections and run at 1,850 r.p.m. They have horizontal split castings giving easy access to all moving parts. Each pump is direct connected by means of a flexible coupling to a single stage, impulse steam turbine, mounted on same sub-base on concrete foundations. The pumps are provided with a 1 in. by-pass valve for operating at slow speeds, and are connected to the heating system separately, so that either unit can be operated independently as desired. The pumps and turbines are of the "De Laval" type and were supplied by the Turbine Equipment Co., Toronto. The heating system was installed by the General Fire Extinguisher Co., Toronto.



FAN ROOM, SHOWING VENTILATING EQUIPMENT.

Ventilating System

The ventilating system is of the plenum type, the building being divided into two sections, each having its own fan and air washer, etc. Approximately 180,000 cubic feet of air is supplied per minute, warmed to 70 degrees Fah., washed, purified, humidified and passed through over five miles of galvanized iron ducts. The two large fans installed in the sub-basement are of the "Keith" type, and were supplied by Sheldons, Ltd., Galt, Ont. Each fan is of double width and full housed, with 70 in. diameter wheel. There are two inlets each 72 in. diameter and the outlet is 60 in. by 90 in. The capacity is 90,000 cubic ft. of air per minute when running at 180 r.p.m. Each fan is driven by a 12-in. x 12-in. horizontal central crank engine built by Sheldons, Ltd., Galt.



FORCED HOT WATER HEATING EQUIPMENT.

The air washing and humidifying apparatus was supplied by the Carrier Air Distributing Co. of America, New York. The primary heaters of the "vento" type are arranged in two groups, each three sections high and 34 wide, each section containing 13.5 sq. ft. of radiating surface. The tempering coil is made up of two and three heating coils of four banks deep, therefore the primary heater consists of tempering and reheating coils and is made up of six banks containing a total of 16,524 sq. ft. There are also six supplementary heaters each arranged in two banks of nine 60-in. sections or 8-in. centres. The total surface per heater is 198 sq. ft. or 1,188 sq. ft. in the six supplementary heaters.

Each of the above installations is provided with a damper which automatically controls the air flowing to the primary heaters. The damper is controlled by means of a "Johnson" thermostat. The coils are heated by means of hot water from the heating system, each section having an independent connection with the hot water heater; thermometers are provided for indicating the temperature of the water in the heaters.

The air washer has 450 nozzles placed 4 ft. from the eliminators which deflect the air five times and remove superfluous moisture. A tank under the air washer contains the water supply for the air washer. An automatic float valve keeps the water in the tank at a certain level and takes care of the loss of water which is absorbed by the air. The water is pumped from the tank and up to the air washer. A humidifier is connected to the water supply pipe and is arranged so that live steam at reduced pressure can be injected into the water going to the nozzles. A diaphragm on the water supply pipe controls the steam supply, the diaphragm being controlled by a thermostat in the air chamber. A Buffalo centrifugal pump driven by a 15 h.p. C. G. E. motor running at 1,250 r.p.m. circulates the water for the air washer.

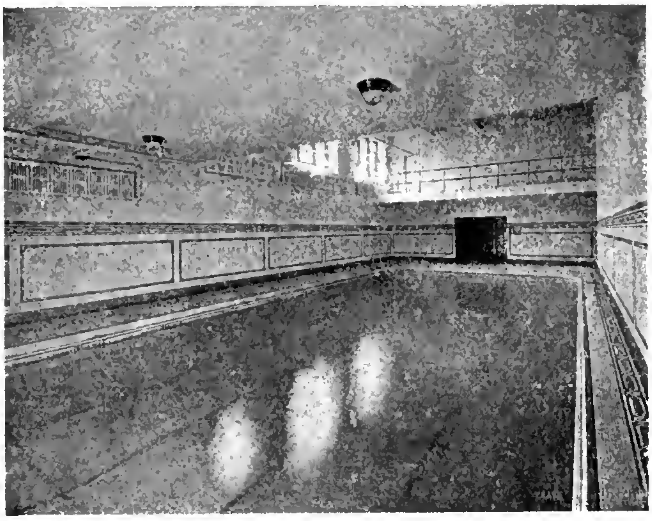
There are also installed two "Keith"

fans for exhausting the air from the toilets. One fan is located in a shaft alongside the stairway in the north side of the building and the other fan in a similar position on the south side. These fans were also supplied by Sheldons, Ltd., and are single width full housed type. Each fan has a capacity of 4,500 cubic feet per minute at 500 r.p.m., and is direct connected to a 2½ h.p. C.G.E. motor. Each motor is supplied with starting and stopping rheostats, cut-out switches, fuses and metal containing boxes. Two "Keith" type fans of Sheldons make, are installed for exhausting from the chemical laboratories. One of these is located in a pent house on the roof in a central position, while the second fan is located on top floor on the west side. Each of these fans has a capacity of 7,000 cubic feet per minute when running at 450 r.p.m., and is direct connected to a 5 h.p. C.G.E. motor. Each motor is equipped with a speed regulating controller and a cut-out starting in a metal containing box.

The draft for the forge shop is supplied by a fan in the fan rooms. This fan is full housed, and has a capacity of 2,000 cubic feet of air per minute at 400 r.p.m. This fan was supplied by the Canadian Sirocco Co., Windsor, Ont., and is driven by a 15 h.p. Canadian Westinghouse motor 230 volts d.c. The motor is controlled by a Cutler hammer rheostat. The entire heating and ventilating equipment was installed by the General Fire Extinguisher Co., Toronto. At the entrance of the large air intake in the subbasement is a rolling door for shutting off the supply of air when the system is not in use. The door is operated by a chain connected to a worm gear drive, the worm gear being driven by a 4 h.p. motor supplied by the Northwestern Mfg. Co., Milwaukee, Wis. The drive gear is located in the air intake near the rolling door.

Wiring and Lighting System

The lighting is d.c., 3-wire, 115-230 volt system, and the current is distributed through the building from six vertical ducts which have an inspection chamber on each floor. All wires are run in galvanized conduits approved by the Canadian Board of Underwriters. Four distributing panels are installed on each floor for the corridor and stairway lighting. The panels are made of black slate, and are equipped with the necessary switches, fuses, etc.



PLUNGE BATH AND SWIMMING POOL.

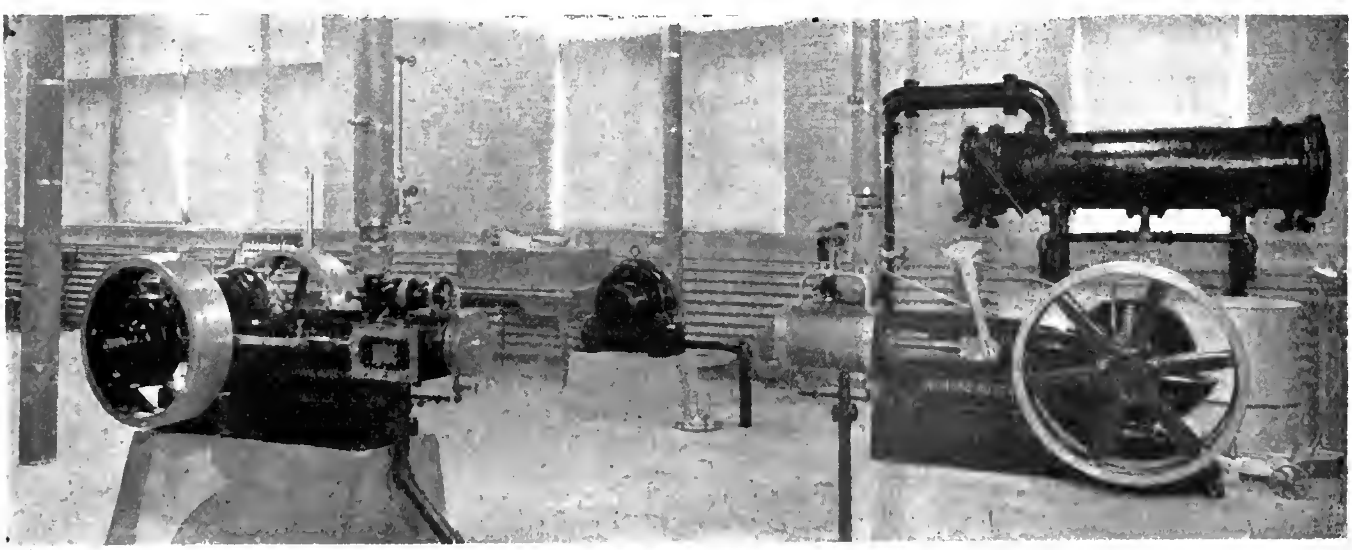
The lighting for the various rooms is distributed from the vertical ducts by means of steel encased panels on each floor. Each room is provided with a push switch, controlling the lighting there. The power for various departments is distributed in the same manner as the lighting current from power panels in the vertical ducts.

The feeders from the main switchboard are run in exposed conduit to the vertical ducts, the power and lighting feeders following the same course. Power feeders run to the machine and wood-working shops, there being a distributing switchboard in each.

The lamps in the various shops are 100 watt tungsten, with white enamelled shades. An exception to this is the machine shop, which has a number of indirect fixtures with single watt tungsten lamps. The power plant and laboratories are equipped with a direct light-system. The fixtures have special ribbed glass bowls each enclosing a 100-watt lamp. The corridor fixtures have translucent bowls each enclosing a 100-watt lamp, while red lights are installed at all the exits. The wiring was installed by Keiths, Ltd., Toronto. The fixtures in the power plant were supplied by the Tallman Brass Co., and the lamps by the Canadian Westinghouse Co., Hamilton, Ont.

Clocks, Telephones, Fire Alarm and Vacuum Cleaning Systems

The clock system was supplied by Howard & Co., Boston, Mass. There are 60 clocks installed throughout the building, all controlled from a master clock located in the assistant principal's office. The master clock has a 12-in. dial, and the movement is so constructed that it will completely wind itself from a 2-volt battery in 10 seconds or less. The secondary clocks in the boiler room, engine room, all the shops and laboratories



STEAM AND GAS ENGINE LABORATORY EQUIPPED WITH ENGINES, TURBINES, SURFACE CONDENSER, AND COMPLETE APPARATUS FOR TESTING POWER PLANT EQUIPMENT.

have 12-in. dials, and are enclosed in air-tight metal cases. All the other secondary clocks have 12-in. dials, and are enclosed in oak cases. A handsome 10-in. dial marble clock is installed in the front of the gallery in the auditorium. Current for the clock system is supplied from two storage batteries which are charged from the power circuit. The clock system was installed by Keith's, Ltd., Toronto.

An intercommunicating telephone system is installed throughout the building. There are at present over seventy stations, but these are being gradually increased as required. Nearly every room will have a telephone when the system is completed. The switchboard is located in the assistant principal's room, and a few lines are connected with the Bell Telephone Co. system. Current is obtained from a storage battery. The system was installed by Keith's, Ltd.. Toronto.

A very complete fire alarm and fire-fighting system is installed. Standpipes are installed throughout the building with a fire hose service at various points in each corridor. The standpipes are connected to the city water supply system. At various points in each corridor are glass break-boxes and bells, the latter of the vibrating type with 12-in. gongs. The bells are connected in multiple and are actuated simultaneously from any one of the fire alarm boxes. Annunciators are located in the assistant principal's room, and also in the engineer's office in the sub-basement. The battery for the system is located in the sub-basement, as is also a charging panel. The fire protection system was installed by the General Fire Extinguisher Co., Toronto, and the fire alarm system by Keith's, Ltd., Toronto.

A vacuum cleaning system is installed throughout the building. The installation is divided into two parts each being handled by a four-sweeper 6½ h.p. "Tuec" machine installed in the fan room, thus making an 8-sweeper plant in all. There are 220 valves in the building to which 50-ft. hose lengths can be attached, and the system is of such size that eight men can clean the building simultaneously without overloading the machines. The machines were supplied by the United Electric Co., Toronto.

Temperature Regulation Systems

The heating system is controlled by the "Johnson" system of temperature regulation. The temperature of each room is regulated by a thermostat which controls by means of compressed air a valve on the outlet of each radiator. The compressed air is furnished by a compressor in the engine room, and will be described later.

The ventilation is also controlled by the "Johnson" system. Roof dampers equipped with diaphragms are controlled from air operated valves located in the fan room. The roof dampers are located in the exhaust air ducts. The switches for operating these dampers are all arranged on a switch-board in the fan room, thus each damper is under the control of the engineers. The compressed air for the system is furnished by a duplex steam-driven pump located near the switch-board. There is also a motor-driven air pump used as an auxiliary. Air is pumped into tank at 30 lbs. pressure; this supplies a low-pressure tank and the system with air at 15 lbs. pressure. An automatic control is fitted and so arranged that if the steam pump fails the electric pump will take its place. The entire heat regulating system was supplied and installed by the Johnson Temperature Regulating Co., Toronto.

Swimming Tank

A well-equipped part of the plant is the swimming tank, and in connection with it, showers and dressing rooms. The plunge is 50 feet long by 25 feet wide, 6 feet deep in the centre and 5 feet and 4 feet respectively at the ends. It is lined with white glazed tile and is provided with continuous filtration. The filtration and heating plant is located in the pump room, the former having a capacity of 4,000 gallons per hour. The filter is of the pressure type and was supplied by the New York Continental Jewell Filtration Co., New York. The centrifugal pump was supplied by the Smart-Turner Co., and is driven by a 2 h.p. Canadian Westinghouse variable speed motor. Adjoining the filter is a water heater under thermostatic control. The latter is of the floating head type and is heated by live steam which passes through a reducing valve, or it can be by-passed.

The pump draws water from the lowest point in the swimming tank and delivers it to the heater. It is then filtered and returned to the tank. The system is so arranged that city water can be connected to the return pipe and then through the filter. The system is also arranged so that the engineer in engine room can tell the level of water in the tank. A "Johnson" thermostat control is installed in connection with this plant.

Steam and Gas Engine Laboratory

The equipment in this section is essentially for demonstrating the operating features of prime movers for the students. The equipment consists of two steam engines, a steam turbine and a condenser, while there is also apparatus for testing and research work. In course of time other equipment will be installed such as gas and gasoline engines, etc. There is ample space provided for further equipment.

Among the units installed is a horizontal high-speed centre-crank, 7-in. x 8-in. engine built by Leonard & Sons, London. Ont. This engine has a simple slide-valve, and the valve gear is so arranged that the valve may be adjusted to any desired travel, and any angular advance may be instantly applied to the eccentric. The engine is equipped with indicator connections to the cylinders and also to the steam pipe and steam chest. Experiments can be conducted with leaky pistons or valves and any other common derangement of a steam engine. The engine is equipped with a "Gardner" governor having a wide range of adjustment. Another unit is a "Leonard" engine of the same type and size as the one described above. This engine is equipped with an inertia shaft governor and ball valve. The governor is of course attached to the flywheel, which is bolted to a disc keyed to the crank-shaft in such a way that any governor position, also any weight of governor and spring tension, can be conveniently obtained.

There is also installed a 30 h.p. "Waite" steam turbine for experimental purposes supplied by Goldie & McCulloch, Galt, Ont. This turbine has a special Goldie & McCulloch dynamometer which has an exceptional range of application and special provision for water cooling. The experimental idea is fully carried out in this machine as well as in the other units as regards facilities for examining and adjusting all working parts.

Steam is supplied from the main boilers, the supply being so controlled with valves that any desired steam pressure can be obtained for any of the units. The exhaust steam is piped to a trench in the floor and may be discharged direct to the atmosphere or to a condenser. The condenser was made by the John Inglis Co., Toronto, and has 150 sq. ft. of cooling surface. It is provided with air pump connections. In connection with the condenser are two 60-gallon capacity measuring tanks, and two 1,200-pounds capacity portable "Fairbanks" scales. The tanks and scales are for measuring condensate to obtain amount of steam used.

The laboratory is equipped with pyrometers, calorimeters indicators, dynamometers, etc., and apparatus is being installed for testing lubricating oils, fuel, gases, etc. There will also be a collection of engine models, power plant apparatus and manufacturers' catalogues, the latter being for reference. The laboratory is also used as a lecture room and is furnished for this purpose. The piping was installed by the General Fire Extinguisher Co., Toronto.

Passenger Elevator

The passenger elevator is on the west side of the building, and serves from the basement to the top floor at a speed

of 250 ft. per minute, and with a capacity of 3,000 lbs. It runs in a fire-proof shaft, the machinery being located in the pent-house situated directly over the hatchway.

A car switch is provided with centreing device so that should the operator take his hand off the handle, the switch will immediately return to centre position and stop the car. The car is also equipped with wedge operated safety grips underneath the car platform.

Freight Elevator

The freight elevator serves from basement to top floor with a speed of 75 ft. per minute, and has a capacity of 4,000 lbs. The winding machine is of the direct connected type, and is placed in the pent house.

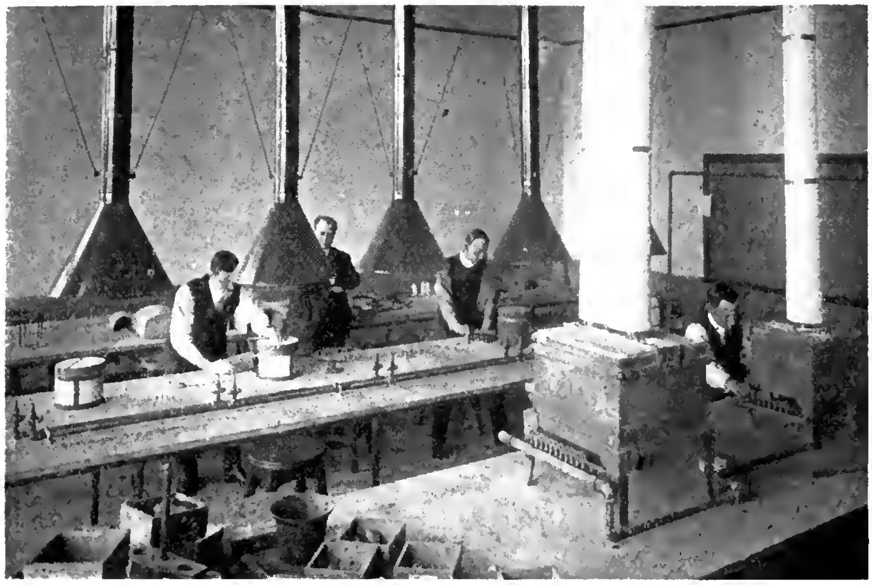
The gearing is constructed with steel worm and bronze worm wheel enclosed in heavy gear case, and running in oil to secure thorough lubrication. Other equipment consists of electric brake, automatic limit stops and automatic slack cable device. The motor is of 15 h.p. capacity, 230 volts, d.c., 4-pole, with commutating interpoles.

The operation is that of ordinary freight elevators, a hand cable passing up and down the side of hatchway. Steel guides are used for both car and counter-weight. The car is of hardwood construction, enclosed with neat hardwood sheeting on three sides with heavy wire screen on top.

Ash Hoist

The ash hoist is of the hydraulic plunger type, serving from boiler room to sidewalk. It has a capacity of 1,500 lbs., and a speed of 60 ft. per minute. The water pressure is 60 lbs. per square inch. This is used to lift ashes from the boiler room, and is provided with an iron door at the top which is opened and closed automatically by the car.

The lay-out of the power plant was prepared by the Canadian Domestic Engineering Co., Toronto, who also supervised the installation of the various units in both the power plant and gas and steam engine laboratory. The switchboard, while being designed by the Canadian Domestic Engineering Co., was supplied by the Northern Electric Co., and installed as has already been stated, by Keith's, Ltd.



METALLURGICAL LABORATORY WHERE ORES AND QUARTZ ARE ASSAYED AND PROPERTIES OF METALS STUDIED.

Art and Domestic Science

Instruction in cast, object and life drawing is provided, while the more useful forms of art such as clay modelling, pottery, stained glass work, metal work and wood carving form an important proportion of the school's activity.

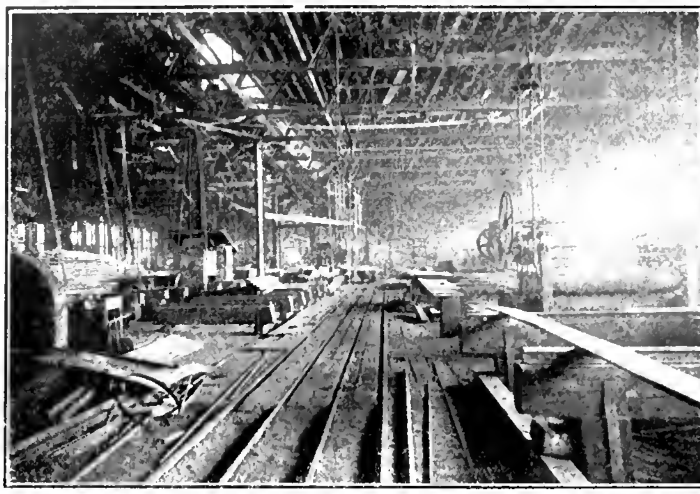
The influence of knowledge on the details of everyday life is further demonstrated by the provision of suitable equipment for the education of future housekeepers in the various branches of Domestic Science.

Four kitchens, each 40 ft. x 30 ft. are furnished with individual stoves, utensils and tables for twenty-four students, while a separate supply room with refrigeration serves each kitchen. Laundry, sewing and dressmaking rooms, and a suite of rooms for housekeeping demonstration indicate the extreme thoroughness with which the question of technical education has been handled by the authorities, and if the students avail themselves to even a small extent of the opportunities for acquiring knowledge, the ultimate influence of such an institution on Canadian industrial life may well be far reaching, beneficial, and permanent, not only as a direct result of the teaching in the school itself, but through the general improvement in technical education throughout the Dominion which must undoubtedly take place as similar kindred institutions endeavor to emulate the worthy example and high standard set up by the Central Technical School, Toronto.

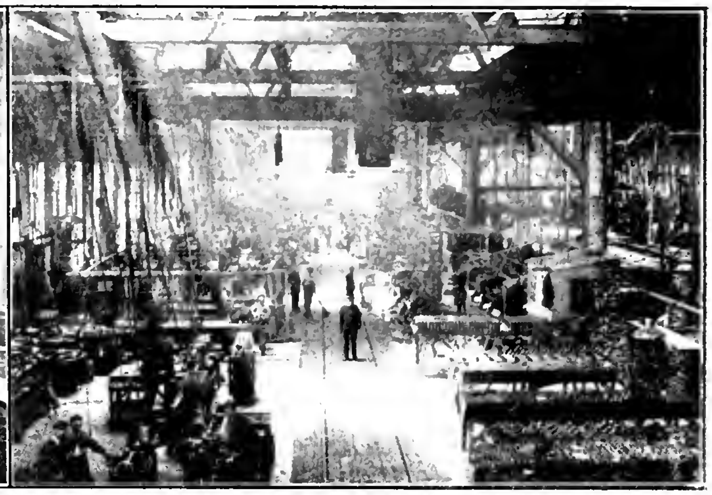
LABORATORY FOR QUALITATIVE CHEMISTRY. STUDENTS ARE HERE TAUGHT THE PRINCIPLES OF ANALYSIS.

For permission to prepare this article we are indebted to A. C. McKay, B.A., LL.D., Principal of the School, while Assistant Principals, W. S. Kirkland, M.A., and J. M. Warren, B.A., through their courtesy and direction contributed greatly to the pleasure of the work. Our thanks are due to the various directors of departments for special information and facilities afforded in the preparation of illustrations, etc.

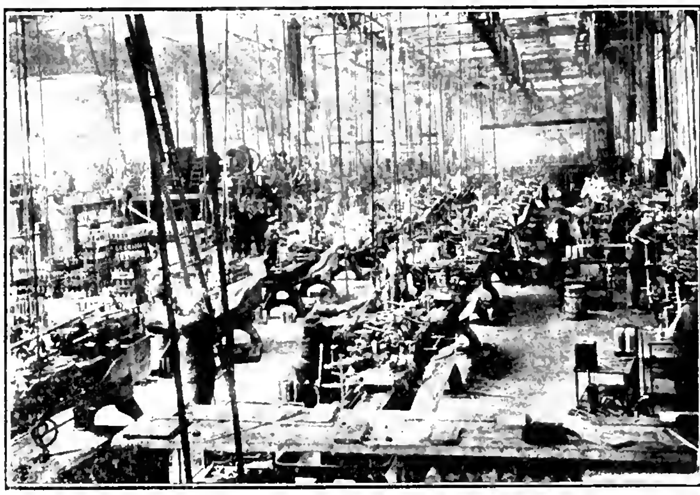
Canadian Structural Steel Plant Organised and Equipped for the Manufacture of Shells



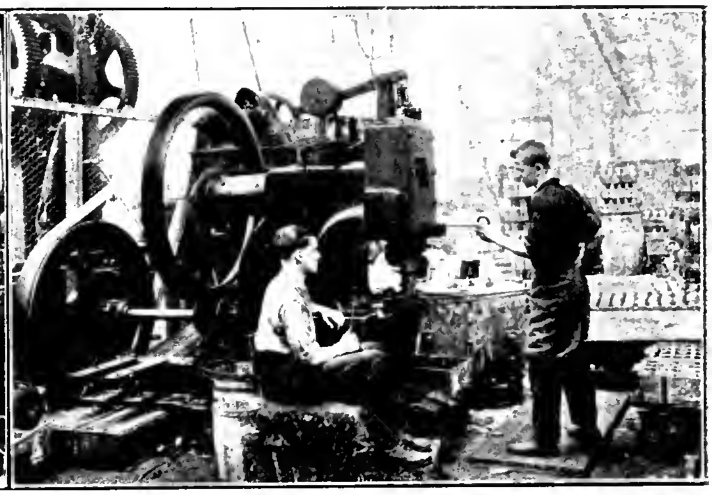
PEACE TIME VIEW OF SHOP.



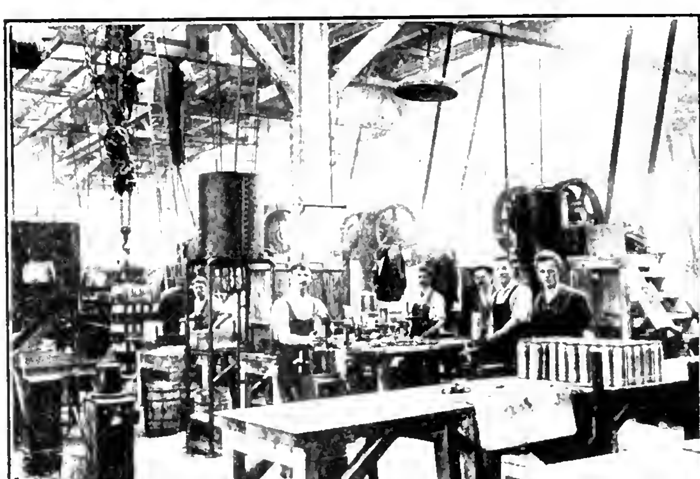
AS IT APPEARS IN WAR TIME.



SHELL BODY TURNING DEPARTMENT.



NOSING SHELLS WITH ADAPTED EQUIPMENT.

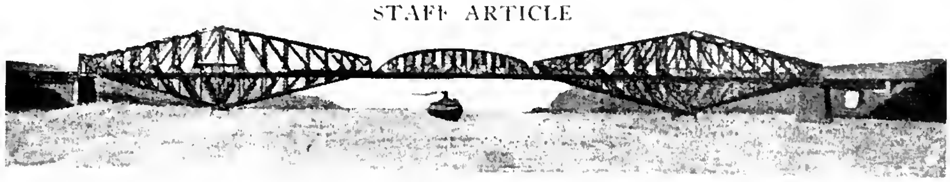


SHELL ASSEMBLING DEPARTMENT.

GOVERNMENT INSPECTION DEPARTMENT.

ERECTING THE NEW QUEBEC BRIDGE

STAFF ARTICLE



Public interest in the Quebec Bridge is again manifesting itself as the work of erection proceeds rapidly and successfully. The structure is now at approximately the same stage of completion as its ill-fated predecessor at the time of its collapse. The actual linking up of rails is scheduled for the fall of 1916, and the work from now on will occupy an increasingly important position in the ranks of Canada's many great national engineering feats.

DURING the past year, despite the unsettled conditions of the country, the progress of the erection of the new Quebec Bridge across the St. Lawrence River has been very satisfactory. At the close of last year the north shore anchor arm had been completed, with the exception of the upper portions of the three panels adjoining the main pier. The north portal and approach to the main structure was erected during the winter, also a certain amount of riveting.

The appearance of the structure at the commencement of operations in the spring of 1915 is shown in Fig. 1. About the middle of April the work was again started, and for the past eight months the pre-arranged programme of the contractors has been closely followed; in fact, certain sections were erected in shorter time than had been expected. The main posts, 10 feet square, which had been fabricated at the shops of the St. Lawrence Bridge Works, near Montreal, were transported by rail to the bridge site in twenty-seven separate sections, with the splice plates attached. The erection of these various sections necessitated very careful and accurate handling of the cranes and hoisting equipment. At the point where these various sections are spliced together, temporary platforms were constructed for the use of the men when riveting up the splices. This work is now practically completed. To enable the reader to have some conception of the massiveness of this structure, and the ingenuity demanded in the assembling of these many details, we would refer to Fig. 2. This shows the cap and top chord connection which forms the upper end of the main post. This piece alone weighs nearly 72 tons, and will be 310 feet above the main shoe, which rests on the concrete pier.

The work of assembling the structure proceeds on both sides simultaneously. The two north shore main posts, weighing approximately 1,000 tons each, were erected in thirty days. The main panels adjoining the centre posts were also assembled in about thirty days; the second panel on the north shore cantilever was completed in twenty-one days, with proportionately shorter periods on the successive panels.

Each section of the cantilever arm is completed as the work progresses, the rear boom of the traveller placing the bracing in position, while the side members of the forward panel are being erected by the front boom.

An interesting feature in the erection of the lower chords is the use of a steel platform called a "flying bridge." These chords have a vertical splice midway between panel supports, and it was necessary to construct this platform so as to take in one complete panel. The "flying bridge" is supported at the shore end by means of pins connected to the chords, and the outer end is held in position by means of links extending down from the upper web numbers. The platform is moved to a new position by the travelling crane.

Due to the fact that work is progressing from both sides of the river, it is essential that accurate calculations and observations be taken at stated periods of construction, to insure the perfect alignment of the structure. This is one of the chief points in connection with this huge engineering undertaking. When the north shore anchor arm was completed, the main post was

FIG. 1. NORTH ANCHOR ARM AS IT APPEARED ON NOVEMBER 30, 1914.

about fifteen inches out of plumb, due to the unbalanced weight of the uncompleted structure. At this stage of construction the lower chord had a camber or sag of several inches, while the members of the upper chord were so constructed that they were bolted in position temporarily while the cantilever arm was being constructed. As each panel of the cantilever arm was erected, its weight balanced that of the corresponding panel on the anchor arm, and the members of this panel were then permanently secured. As each succeeding section of the river arm was completed the corresponding shore arm section was secured in position. At the present stage, when the north shore structure is practically finished, the main post is still about five inches out of plumb. However, the calculations have proven so accurate that when the centre span is in position the centre post of each main truss will be practically perpendicular.

To test the accuracy of their calculations, the designers, at the completion of the cantilever arm, jacked up the shore or anchor arm to see what pressure was necessary to balance the structure, and their expectations were more than realized when they found they were within a few thousand pounds of the predetermined amount.

Another interesting feature is that of maintaining alignment of uprights and equalizing the strain during construction of the outer arms. In the triangle formed by the centre post and the main tension and compression members of the anchor arm main panel, a large horizontal brace, fitted with an adjusting screw, was used to overcome any undue stress in the various members caused by the continual changing in the shape of the panels as weight was added to the cantilever arm.

FIG. 5. NORTH SHORE TRUSS AS IT APPEARED ON NOVEMBER 7, 1915.

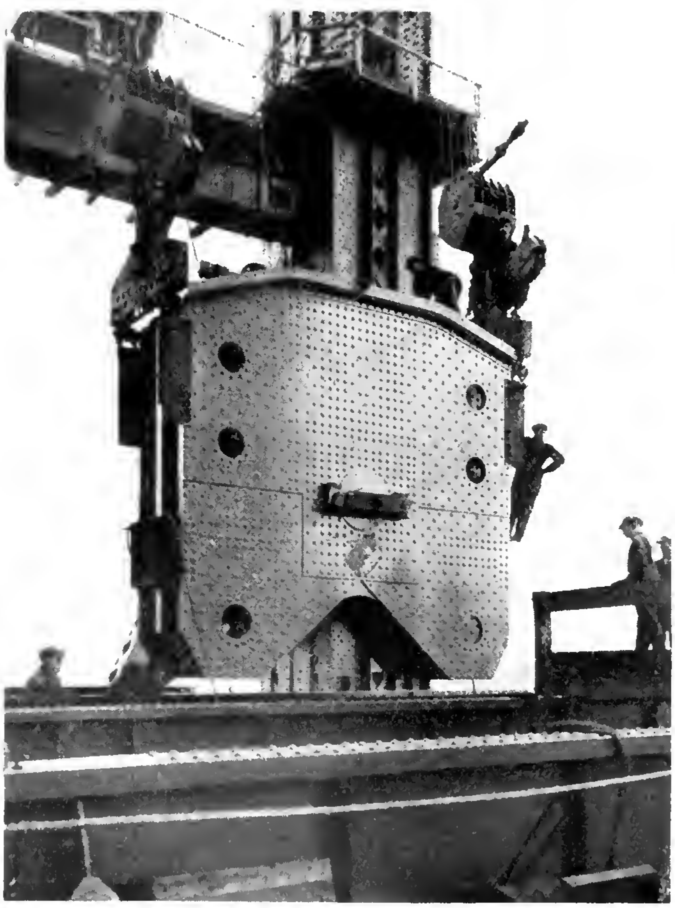


FIG. 2. MAIN POST CAP AND CHORD CONNECTION BEING HOISTED INTO PLACE.

The work on the south shore is progressing more rapidly than did that on the opposite side, as the experience gained in the erection of the north anchor arm and its falsework has greatly facilitated later construction.

On the south shore, the portal and anchor arm are finished as far as presently possible. Fig. 3 is a view of the south anchor arm as it appeared at the end of November, 1915. During the winter months little can be accomplished and work on the structure will be suspended until the arrival of milder weather next spring.

At the close of November, 1915, actual construction work on the north shore end was completed, with the exception of some riveting and other detail features. Since the middle of November workmen have been busy removing the falsework from beneath the anchor arm, and are also removing the traveler, which will be taken to the site where the centre span will be constructed.

The photograph reproduced in Fig. 4 shows an excellent view of the existing structure as it extends out over the waters of the St. Lawrence River, like the arm of some giant sentinel.

The view shown in Fig. 5 was taken from the south side of the river early in November, as the work on the north was just being completed.

At present about 150 men are employed at the works completing the fabricated material for next year's work. This part of the work is expected to be finished early in the spring. Some time in April operations will commence on the cantilever arm of the north shore truss; at the same time work will begin on the assembling of the centre span. This suspended portion, which will be 640 feet long and 88 feet wide, centre to centre of side trusses, will be 110 feet high at the centre, and will weigh approximately 6,000 tons. It will be erected at Sillery—about three miles below the bridge—on six specially-constructed pontoons, with falsework supported on concrete piers. Each pontoon will be 185 feet long, 32 feet wide and 12 feet deep, with steel frames and stiffening trusses, wooden sheeting and flooring.

It is anticipated that this section will

be ready when the south truss has been completed. The finished span will then be floated up the river and anchored in position beneath the bridge. The span will then be raised to its final position, a distance of 140 feet, by means of 2,000-ton jacks placed at each corner, and specially-designed hangers suspended from each of the cantilever arms. If the schedule of operations of next year's work can be carried out as successfully as the past year's programme, the feat of placing the suspended span in position will take place some time in October, and the bridge will be ready for the passage of trains in November, 1916. However, the regular traffic across the river will not take place until the spring of 1917. During the winter of '16 and '17 a great amount of detail work will be completed, such as the laying of walks, painting, etc.

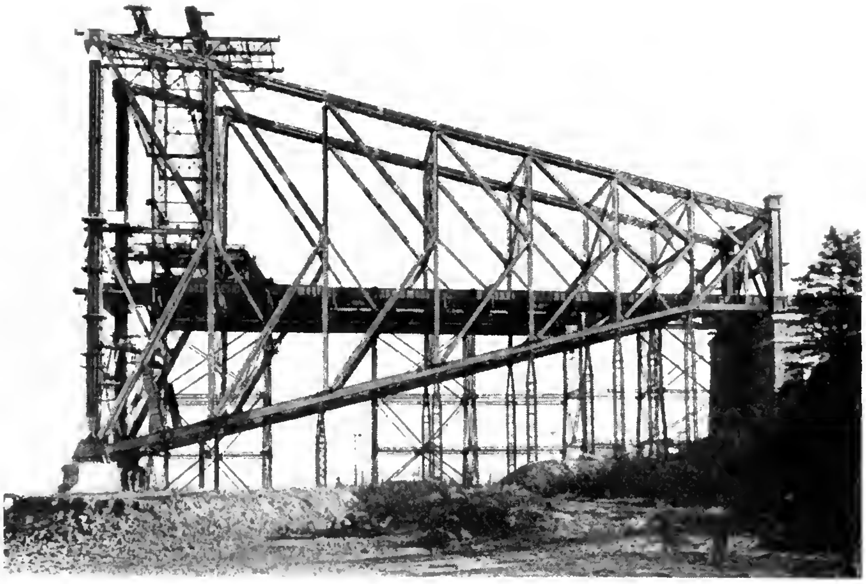


FIG. 3. SOUTH SHORE ANCHOR AS IT APPEARED ON NOVEMBER 11TH, 1915.

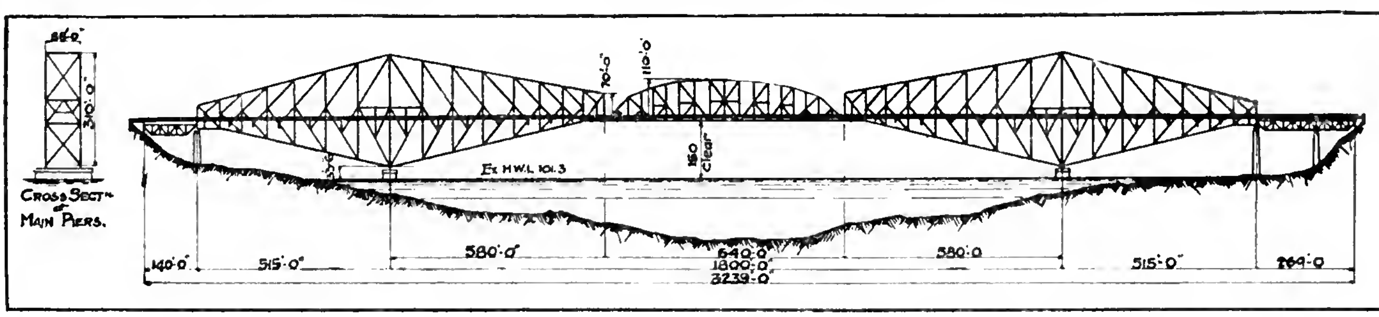
At the close of this season's work 45,000 tons of steel have been placed in position, and when the completed structure has been finally erected the total weight resting on the main piers will be about 65,000 tons, 55,000 tons being fabricated material.

Owing to the climatic conditions, and the wide range of temperature between midsummer and midwinter, which is from 100 to 120 degrees F, about 30 inches must be allowed for expansion and contraction in the total length of the bridge.

It is difficult to appreciate the magnitude of this undertaking from a brief description of the work being done. One requires to see the various component parts in course of construction and observe the manner in which the many problems of erection are being successfully overcome.

The designing, construction and erection of this bridge form one of the great engineering feats of modern times, and the official opening of this wonderful structure will mark the completion of the last link in the unbroken rail-to-rail highway, which will then extend from ocean to ocean.

A noteworthy feature of the work is the immunity from accident during erection. From the nature of the undertaking, a steady percentage of minor casualties is to be expected, but the number of fatalities has been surprisingly low. The efforts of the company to provide comfortable and attractive camp life for the men have met with all the success deserved, and such conditions have doubtless exerted a restraining influence on the workmen in exercising more than ordinary care in performing their duties.



SKELETON VIEW OF THE QUEBEC BRIDGE, SHOWING PRINCIPAL DIMENSIONS.

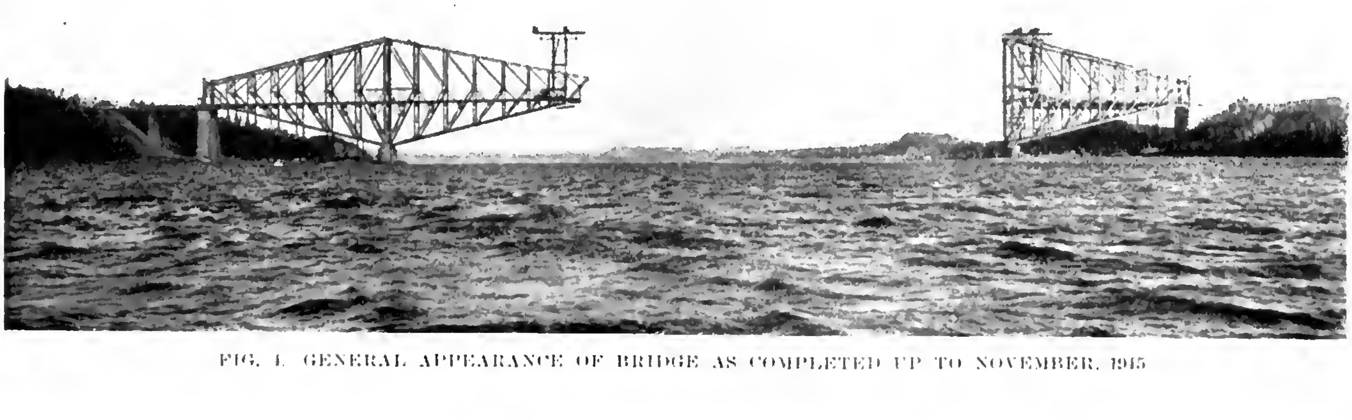
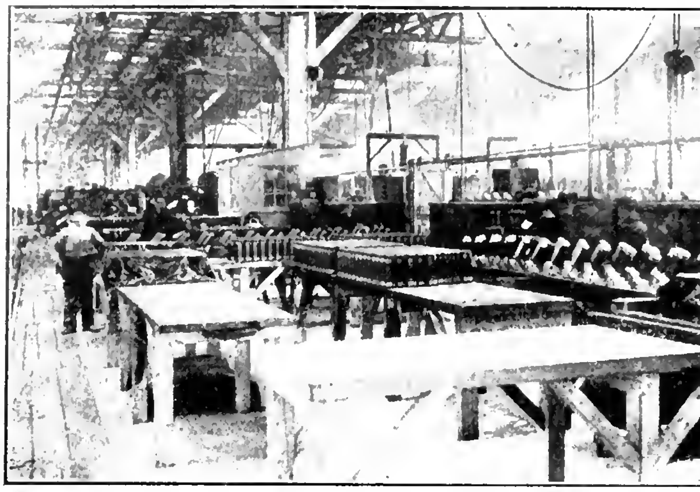
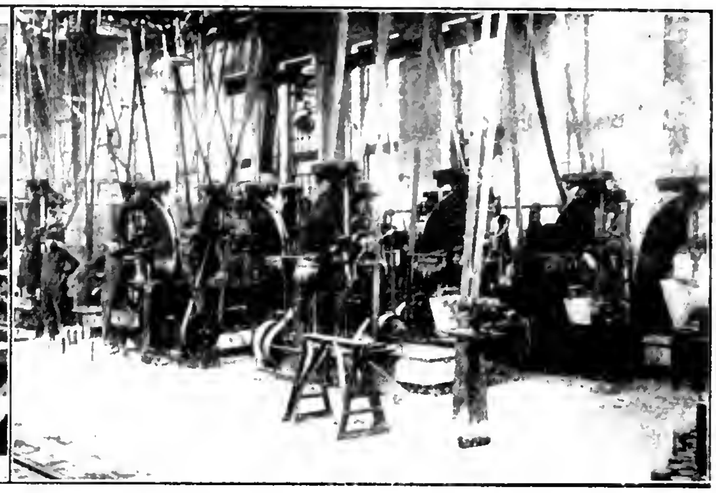


FIG. 4. GENERAL APPEARANCE OF BRIDGE AS COMPLETED UP TO NOVEMBER, 1915

Canadian Structural Steel Plant Organised and Equipped for the Manufacture of Shells

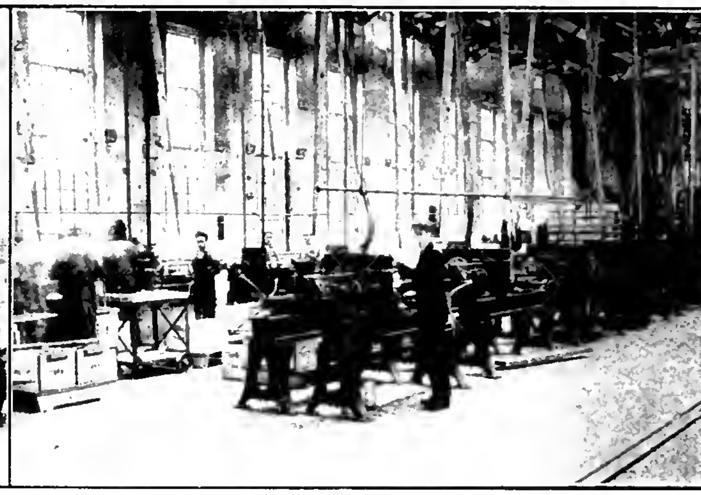


SHELL PAINTING DEPARTMENT.

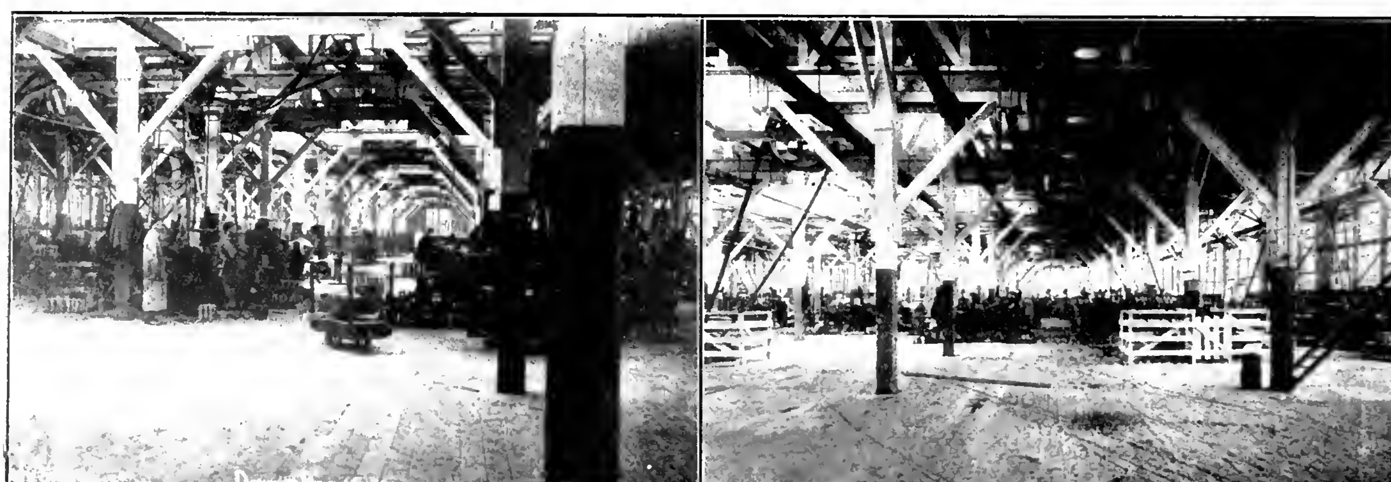


DRILLING H. E. SHELL BLANKS.

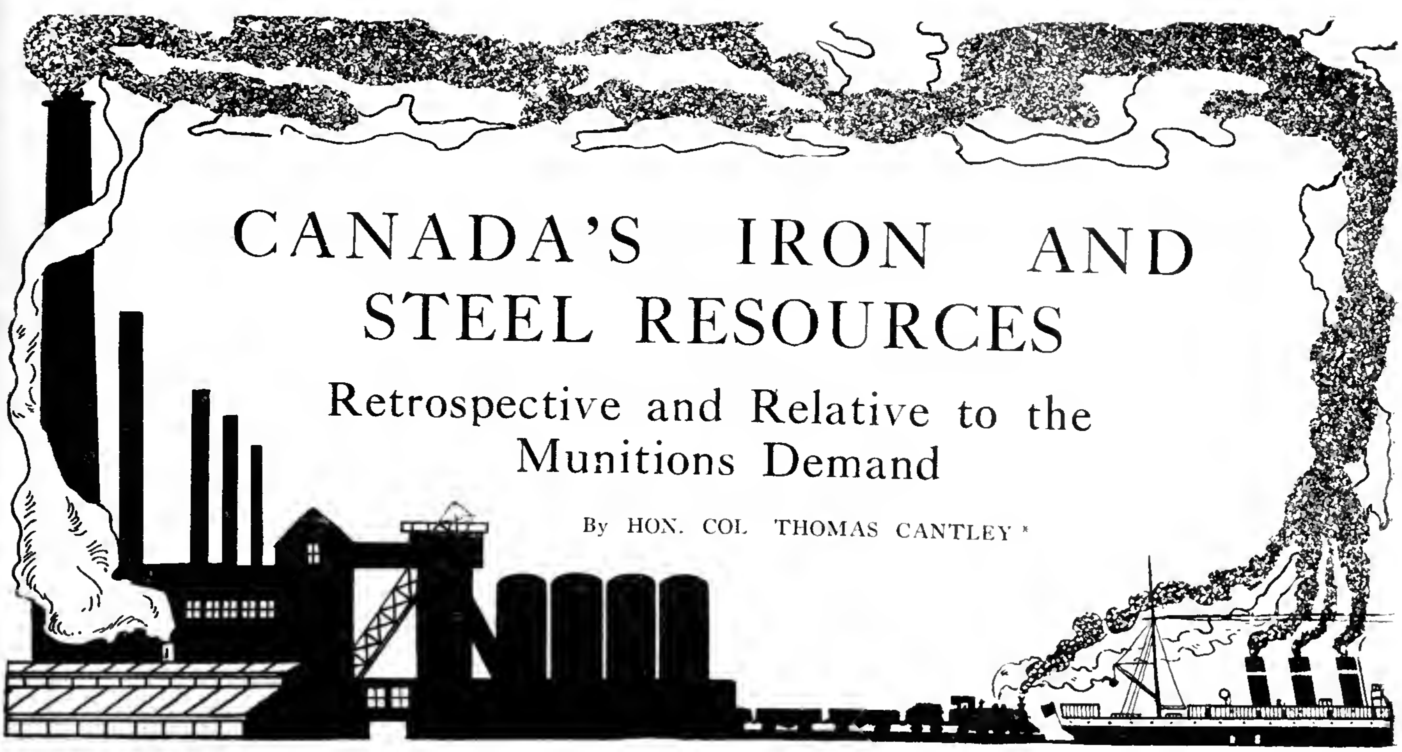
FURNACES, QUENCHING TANKS AND TROLLEYS.



BATTERY OF LATHES ON SHELL WORK.



INTERIOR VIEWS OF SHOP SPECIALLY BUILT FOR SHELL MAKING.



CANADA'S IRON AND STEEL RESOURCES

Retrospective and Relative to the Munitions Demand

By HON. COL. THOMAS CANTLEY*

Steel prices covering every description of commodity into which the material enters have advanced to a prodigious extent, and we are certain that the limit has not nearly been reached. More than usual interest, as a result, is being taken in the question of Canada's resources, both as regards ore areas developed and available and plant equipment installed.

THE steel industry of Canada is represented by plants in three of the Eastern provinces—viz., Nova Scotia, Quebec and Ontario. Those of the first and last mentioned provinces are the most important, supplying over 99 per cent. of the total production. Probably the first effort in iron smelting in Canada was made in the Province of Quebec. During the early decades of the last century we find that various small enterprises were started in all three provinces—charcoal being used as fuel and local ores smelted. The amount of metal produced, however, was very small.

Nova Scotia

The Londonderry district in Nova Scotia was the first to assume commercial importance, and quite modern furnaces and plant were laid down about the middle of the last century. Iron was made here about the same date, and a rolling mill installed in 1860. It is of interest to note that the pig iron made at Londonderry had quite a good reputation, and was in demand. It is said that owing to its superior quality the British War Office, upon the recommendation of Sir William Fairburn and others, used it for the manufacture of ordnance in those days, and imported it into England for that purpose.

About 1875 there was further development in this district, with important additions to plant, coke pig iron being then made for the first time in Canada in a commercial way.

In a paper written on the iron and steel industry in 1885, Londonderry is referred to as the "site of the most important iron works in the Dominion." Up to 1887 it has produced over 200,000 tons of pig iron smelted from local ore—42,000 tons bar iron and forgings, and 40,000 tons of nail plate, wheels and castings. Operations at Londonderry have since been carried on intermittently—the last pig iron being made in 1908, and steel in 1912.

Further east in Nova Scotia, at New Glasgow, the first steel was made on a commercial basis in 1883, when two 20-ton acid-lined open-hearth furnaces were put in operation. Imported pig was used. Four years later the basic open-hearth process was adopted, thus making it possible to use local pig iron. Since this date all steel made in Nova Scotia has been exclusively basic open-hearth.

The first iron made in the Pictou district was by the General Mining Association, then operating collieries at Albion Mines in 1826, when they smelted local ores, using native flux with Beehive coke made from Pictou coal. Owing to the refractory nature of the ore used, the venture was not a success, and operations were discontinued. In Cape Breton the first pig iron and steel was made in 1899, and from this date on this has been the most important steel district in the province.

Quebec

From old records we learn of activity of the early French settlers in the Province of Quebec. How in 1737 the right of mining and smelting iron ore in the district of St. Maurice, near Three Rivers, was granted to a company by Louis XIV. From that date until a year or so ago mining and dredging of bog ore and smelting has been carried on around this district almost continuously on a small scale.

Attempts to smelt iron on a commercial scale were made at Moise in 1867, at St. Urban in 1873, at Hull in 1887 and 1872, but none with commercial success.

At Radnor and Drummondville, furnaces have been operated continuously from 1887 to 1912, using local ore, with locally-made charcoal as fuel. An average of about 8,000 tons per annum was made.

At the date of writing there are no blast furnaces in operation, and the only steel produced is in small open-hearth furnaces and electric furnaces, making castings, or the crucible method, making special steels, the tonnage involved being relatively small.

Ontario

An iron furnace was erected in Leeds County about 1800 and a second in Normandale a few years later. These initial efforts proved failures, but in 1832

*President and General Manager Nova Scotia Steel and Coal Co.

work was resumed by the other operators, and was carried on until 1847. The Marmora furnace, established in 1820, was unprofitably operated at intervals until 1875. A furnace was erected at Madoc ,and operated for eight or nine years; also at Houghton in 1854, and Burnt River, Haliburton County.

All these enterprises proved to be failures commercially, and we find in 1892 the Province of Ontario was without a single blast furnace. Two years later, in 1894, furnaces were put in operation at Hamilton by a company which now forms part of the Steel Company of Canada. These furnaces have been operated continuously since, and the growth for the following decade was rapid.

So much for history. The industry as it exists to-day may be conveniently considered as divided into two groups—one in Nova Scotia, the other in Ontario. This, both because the plants in both these districts form a natural unit, geographically and metallurgically.

Nova Scotia

In Nova Scotia the Nova Scotia Steel & Coal Co. and the Dominion Steel Corporation operate under almost identical conditions—they use ore and coal from the same beds and generally have the same metallurgical problems to overcome.

Ontario

The Ontario district may be subdivided into that of the Niagara Peninsula and the Lake Superior groups. All the important companies operate in the whole area, however, under very similar metallurgical conditions.

Niagara Peninsula

The important companies operating on the Niagara Peninsula are:

The Steel Company of Canada.

Canada Iron Corporation—Furnaces at Midland.

Canada Furnace Company—Furnaces at Port Colborne.

Standard Iron Company—Furnaces at Deseronto.

Lake Superior District

In the Lake Superior district:

The Algoma Steel Corporation—Furnaces at Sault Ste. Marie.

The Atikokan Iron Co.—Furnaces at Port Arthur.

We will now consider the different districts more in detail.

Nova Scotia

All its steel is made from Wabana, Newfoundland, ore smelted with retort oven coke, made locally from Cape Breton coal, local flux being used. The blast furnaces are seven in number, with a capacity of 1,930 tons per day. Open-hearth furnaces, including mixers, number eighteen, and also two 15-ton Bessemer converters.

Nova Scotia Output for 1913

Coke made, 713,000 tons, all from N. S. coal.

Iron ore imported, 940,000 tons, chiefly from Wabana.

Iron ore exported, 13,000 tons.

Pig iron made, 438,000 tons.

Limestone quarried, 514,000 tons.

Steel ingots made, 435,000 tons.

Nails made, 175,000 tons.

Steel billets made, 20,000 tons.

Rails made, 320,000 tons.

Merchant mill product, 19,000 tons.

The Atikokan Iron Company has a furnace in this district with a capacity of 100 tons per day, which has been idle since 1911.

The ores smelted in this district are partly native (Helen and Magpie Mines), but the greater part is imported from the American Lake Superior ore field. The fuel used is partly locally-made charcoal, but chiefly imported coke

HON. COL. THOMAS CANTLEY,
President and General Manager, Nova Scotia Steel & Coal Co., New Glasgow, N.S.

Steel billets for market, wire rods, merchant bar, wire and nail products, and forgings, 180,000 tons.

Lake Superior District

In the Lake Superior district there are four blast furnaces with a capacity of 1,050 tons per day, five steel furnaces, and two Bessemer converters. During 1913 this district produced the following material:

Algoma Steel Company

Pig iron made, 308,000 tons.

Coke made from American coal, 411,-000 tons.

Steel ingots made, 438,000 tons.

from Illinois or Pennsylvania. Recently 110 Koppers coke ovens have been built at the Sault for the purpose of coking imported coal at the furnace and saving the breakages inevitably obtained in transportation of coke. In 1913, some 600,000 tons of coal was imported for this purpose and 419,000 tons coke made.

Niagara Peninsula District

In this district there are seven blast furnaces with a daily capacity of 900 tons. The greater part of the ore and all of the fuel is imported for these furnaces, although a couple of the smaller companies use a certain tonnage of

local ores. Seven open-hearth furnaces provide the steel-making capacity of about 350,000 tons per year.

The Steel Company of Canada report having made 180,000 tons of pig iron, 157,000 tons of steel ingots, and 192,000 tons of finished merchant bar steel in 1913. The following statistics will be of interest:

Coke.—Coke made in Canada by the following companies:

On page 626 is given a table of particulars of steel furnaces and rolling mills.

List of Manufacturers of Oven Coke

Operation.	Address	No. of Ovens and Type.	Location of Ovens.
Intercol. Coal Mfg. Co.	Montreal	36 Bee Hive	Westiville, N.S.
Londonderry I. & M. Co., Ltd.	Montreal	Bee Hive	Londonderry, N.S.
N.S.S. & C. Co., Ltd.	N. Glasgow, N.S.	120 Bernard	
		30 Bauer	Sydney Mines, N.S.
Dom. Iron & Steel Co.	Sydney, N.S.	620 Otto Hoffman	Sydney, N.S.
Atikokan Iron Co., Ltd.	Port Arthur, Ont.	100 Bee Hive	Port Arthur, Ont.
The Algoma Steel Corp.	Sault Ste. Marie, Ont.	110 Hoppers	Sault Ste. Marie, Ont.

Raw Materials Consumed in Blast Furnaces, 1910-1914

	Total Consumption of:				Consumption per ton of Iron made			
Years	Ore cinder, etc. Gross Tons	Lime Stone Gross Tons	Coke Net Tons	Charcoal Bushels	Ore cinder, etc. Lbs.	Lime Stone Lbs.	Coke Lbs.	Charcoal Bushels
1910	1,453,910	510,650	......	......	4,395.8	1,545.3	....	....
1911	1,607,354	567,462	......	......	4,307.5	1,541.9	....	....
1912	1,915,165	666,214	1,275,349	1,886,748	4,099.4	1,634.7	2,854.6	97.
1913	2,045,780	705,483	1,413,111	2,206,191	4,514.3	1,556.7	2,843.3	104.2
1914	1,358,184	419,864	910,887	883,625	4,309.4	1,332.2	2,011.4	105.5

Coke.—The Nova Scotia district is in the centre of Cape Breton coal field, and supplied itself with coke, and is thus self-supporting.

The Ontario district obtains all its fuel supply from the United States, either directly in the form of coal or as coke. The coke imported and used in furnaces in 1913 amounted to 706,888 tons.

Iron Ore.—The iron ore production of Canada in 1913 was 307,000 tons. Since then the production in the Province of Nova Scotia and New Brunswick has ceased. Production in Ontario in 1913 was 195,000 tons; in 1914, 244,000 tons. Of the latter amount, 184,000 tons was shipped to Canadian furnaces and 60,000 exported to the United States. Of the 195,000 tons mined in 1913 in Ontario, Helen and Magpie Mines shipped 22,000 tons, Moose Mountain 3,300 tons, Belmont Mines, Hastings Co., shipping to Port Colborne furnaces.

Imports of ore in 1913 from Wabana (Newfoundland) into Cape Breton were 940,000 long tons. Imported into Ontario from the United States 1,072,156 tons.

Flux.—The total limestone used amounted to 630,000 tons, of which 346,000 tons were imported. Previous to 1896, pig iron was made entirely from Canadian ores. Since that date, however, increased quantities of imported ore have been used, as well as imported fuel and flux, and in 1914 about 94 per cent. of the ore used, 50 per cent. of the coke and 56 per cent. of the limestone was imported.

Blast Furnaces

There are 22 blast furnaces in 12 separate plants owned by mine companies, with a total theoretical capacity of 1,500,000 tons. In 1913 five of these furnaces were idle. It is improbable that a greater tonnage than 1,350,000 tons can be obtained in 1915. The following table shows the production of pig iron by grades for 1913—Basic, 558,524; Bessemer, 227,662; Foundry, 225,231; all other, 3,701. Total, 1,015,118.

Blast Furnace Plants

1915. Company.	Address	Location of Plant	Blast Furnaces and Tonnage
The Nova Scotia Steel & Coal Co., Ltd.	New Glasgow, N.S.	Sydney Mines, C.B.	1 completed 250 tons per day
The Dominion Iron & Steel Co.	Montreal, Que.	Sydney, C.B.	6 completed 1680 tons per day
Londonderry Iron & Mining Co., Ltd.	Montreal, Que.	Londonderry, N.S.	
Canada Iron Corporation, Ltd.	Montreal, Que.	Drummondville, Que.	
Canada Iron Corporation, Ltd.	Montreal, Que.	Radnor Forges, Que.	
Canada Iron Corporation, Ltd.	Montreal, Que.	Midland, Ont.	2 completed 375 tons per day
Standard Iron Co. of Canada, Ltd.	Deseronto, Ont.	Deseronto, Ont.	1 completed 112 tons per day
Standard Iron Co. of Canada, Ltd.	Deseronto, Ont.	Parry Sound, Ont.	84 tons per day
The Steel Co. of Canada, Ltd.	Hamilton, Ont.	Hamilton, Ont.	2 completed 540 tons per day
The Canadian Furnace Co.	Port Colborne, Ont.	Port Colborne, Ont.	1 completed 300 tons per day
The Algoma Steel Corporation	Sault Ste. Marie, Ont.	Steelton, Ont.	3 completed 950 tons per day
The Atikokan Iron Co., Ltd.	Port Arthur, Ont.	Port Arthur, Ont.	1 completed 100 tons per day

Steel.—There are four plants with installation of 30 furnaces and four Bessemer converters, having a total capacity of 1,250,000 tons a year. It is improbable that this amount can be exceeded during the coming year by more than 100,000 tons, and it should be borne in mind that 300,000 tons of this capacity is Bessemer steel which is not accepted in the manufacture of munitions. In addition, there are eight or nine steel casting plants, operating either small open-hearth furnaces or converters. The tonnage derived from this source in 1913 was 39,217 tons, when the total production of steel amounted to 1,168,993 tons made by nine companies.

Nickel Copper Smelters

Electric Smelting.—In the above estimates we have not made any allowance for such additional tonnage as might be obtained by electric smelting. The tonnage of steel derived from this source in 1913 was under 5,000 tons, not including the tonnage obtained on ferro-alloys, which amounted to 8,000 tons off. The problem of electric-made steel is a large one. Melting scrap in a relatively inexpensive steel furnace where electric power is cheap is very attractive. This no one doubts. The difficulties that may be encountered in securing any great tonnage in this way, while problematical, are bound to be enormous, and it is unlikely that our figures will have to be changed materially because of the tonnage derived in this way.

Rolling Mills.—The blooming mill capacity of this country will probably handicap the production of war munitions as much as the shortage in steel ingot capacity.

The table on page 626 shows the production of finished rolled products:

In glancing over the statistics of the industry in view of the present crisis in the affairs of Canada and the Empire, for our present purpose it will be noticed that the industry was of a comparatively slow growth. Very little was done before 1880. There was no cogging mill in the country till 1883.

Electric Furnace Plants

For Ferro Products of Steel

Company.	Address.	Location of Plant	Products
The Electric Reduction Co.	Buckingham, Que.	Buckingham, Que.	Ferro Phosphoros
Electric Metals, Ltd.	Welland, Ont.	Welland, Ont.	Ferro-Silicon
Electric Steel & Metals Co.	Welland, Ont.	Welland, Ont.	Steel Castings
Algoma Steel Corporation	Sault Ste. Marie	Sault Ste. Marie	Ferro-Silicon
The Moffat, Irving Steel Works, Ltd.	Toronto	Toronto	Steel Castings
Tivani Electric Steel Co.	Belleville, Ont.	Belleville, Ont.	Steel Castings

*Idle during 1914.

The first great impetus was given by the iron and steel tariff of 1887, brought down by Sir Charles Tupper, that far-

seeing and progressive Canadian, the indomitable fighter, and the Dominion's greatest constructive statesman, who, in the fullness of his days, has so recently rejoined his chief and the other fathers of Confederation. To him full credit should be given for having the faith and the necessary vision to create conditions which led to the foundation being laid upon which our present achievements rest.

With the subsequent changes in import duties there was little further development until the second stage of development commenced at the close of the last century, brought about by the action of the Government in putting in force a graduated system of bounties.

This resulted in large iron and steel enterprises being undertaken both in Nova Scotia and in Ontario, to which we have already referred, with the result that in the latest normal year for which we have complete statistics the production of pig iron was 1,128,967 tons and steel 1,168,993 tons.

It is a melancholy reflection that even in such a banner year as 1913 the iron and steel production of Canada was little more than half the total requirements for the same period.

During 1914, owing to the world-wide depression, which was perhaps even more keenly felt by the iron trade of Canada than of any other country, the output fell off considerably.

Shortly after the outbreak of war, when the British War Office began to look about them for supplies of large types of ammunition, they turned first to the United States, when, thanks to the initiative, energy and courage of the Minister of Militia, General Sir Sam Hughes, Canada was invited to aid in the supply of munitions.

That we were able to do so was due entirely to the fact that in the previous years manufacturers in the older provinces by the sea, where the pioneering work in the iron and steel trade of Canada had been done, were in a position to supply the steel and make the forgings; other manufacturers were able to supply the various component parts. These establishments and other engineering shops the Shell Committee co-ordinated, and thus supplied to the War Office the first order entrusted to them of 200,000 shrapnel shells.

The development of the steel trade of Canada, which made the supplying of these shells possible, later resulted in placing in Canada, between October, 1914, and June 10th of the present year, munition orders alone to the amount of more than $160,000,000 and has provided employment for thousands of workmen, not only in the iron and steel industry, but workers in other metals, and a large army of mechanics, who, so far as can be seen, would otherwise have been without employment.

During the nine months of the present year there has been shipped to Great Britain from Canadian ports more than 4,229,000 shells—about 25 per cent. of which were fixed ammunition. Here perhaps it may be of interest to state that Scotia, who first of the Canadian steel companies undertook to supply shell steel and shrapnel shell forgings, made at their New Glasgow plant in the twelve months ended October 31st last, a total of 2,145,525 shell forgings, more than 20 per cent. of which were of the largest size high explosive shells yet made in Canada.

This munitions work has provided employment for a very large number of workpeople in various walks in life, outside of the iron, steel and closely allied industries. For instance, over 1,000,000 ammunition boxes have been supplied, calling for more than 10,000,000 feet of lumber, while wooden cases for other munition exports have in addition called for more than 25,000,000 feet.

Finished Rolled Iron and Steel, 1895, 1909

Year	Gross tons	Year	Gross tons	Year	Gross tons
1895	66,402	1900	100,000	1905	385,826
1896	75,043	1901	112,077	1906	574,742
1897	77,021	1902	181,485	1907	600,179
1898	90,303	1903	129,516	1908	496,517
1899	110,642	1904	180,038	1909	662,741

Production of Finished Rolled Forms by Leading Products

	1910	1911	1912	1913	1914
Rails	366,465	360,547	423,885	506,709	382,344
Structural shapes and wire rods	80,993	76,617	64,082	68,048	59,050
Plates and sheets, nail plates, merchant bars, tie plate bars, etc.	292,353	344,760	373,257	392,340	218,125
Total gross tons	739,811	781,924	861,224	967,997	659,519

Steel Furnaces and Rolling Mills

Company.	Address	Location of Plant	Products.
The Nova Scotia Steel & Coal Co., Ltd.	New Glasgow, N.S.	Sydney, C.B.	Ingots, billets, plates, sheets, bars, rail joints, forged products.
The Nova Scotia Steel & Coal Co., Ltd.	New Glasgow, N.S.	Trenton, N.S.	
The Dominion Iron & Steel Co.	Montreal, Que.	Sydney, C.B.	Castings, ingots, billets, rails, wire rods, bars and rods, nails, wire products.
Canadian Car & Foundry Co., Ltd.	Amherst, N.S.	Amherst, N.S.	Bars and rods.
The Portland Rolling Mills, Ltd.	St. John, N.B.	St. John, N.B.	Bars.
Can. Steel Foundries, Ltd.	Montreal, Que.	1630 Longue Point, Que.	Castings.
Can. Steel Foundries, Ltd.	Montreal, Que.	P. St. Charles, Que.	
The Steel Co. of Canada, Ltd.	Hamilton, Ont.	Montreal, Notre Dame St. West	Billets, plates, bars, rods, nails, wire.
The Steel Co. of Canada, Ltd.	Hamilton, Ont.	Montreal, St. Patrick St.	Plates, sheets, bars, rods, spikes.
Beauchemin & Fils, Ltd.	Sorel, Que.	Sorel, Que.	Castings.
Joliette Steel & Iron Fdry., Ltd	Joliette, Que.	Joliette, Que.	Castings.
Canadian Rolling Mills Co., Ltd	Montreal, Que.	Montreal, Que.	Bar iron and steel.
Hull Iron & Steel Fdys., Limited	Hull, Que.	Hull, Que.	Castings.
Grand Trunk Rolling Mills	Montreal, Que.	Montreal, Que.	Bars.
Armstrong-Whitworth of Canada, Ltd.	Montreal, Que.	Longueuil, Que.	Ingots, high-speed and crucible steel.
Peck Rolling Mills	Montreal, Que.	St. Paul	
Dom. Steel Foundry	Hamilton, Ont.		Castings.
The Steel Co. of Canada	Hamilton, Ont.		Castings, ingots, billets, blooms, wire rods, rods and bars, spikes.
The Steel Co. of Canada	Hamilton, Ont.	Belleville, Ont.	Bars and rods, spikes.
Burlington Steel Co., Ltd.	Hamilton, Ont.	Sherman Ave., Hamilton	Bars and rods.
Superior Rolling Mills Co.	Ft. William, Ont.	Ft. William, Ont.	
The Moffat, Irving Steel Works, Ltd	Toronto, Ont.	Toronto, Ont.	Castings (electric).
Castings of Ottawa, Ltd.	Ottawa, Ont.	Ottawa, Ont.	Castings.
The William Kennedy & Sons, Ltd	Owen Sound, Ont.	Owen Sound, Ont.	Castings.
Provincial Steel Co.	Cobourg, Ont.	Cobourg, Ont.	
Can. Steel Foundries, Ltd.	Welland, Ont.	Welland, Ont.	Castings
Electric Steel & Metals Co., Ltd	Welland, Ont.	Welland, Ont.	
Algoma Steel Corp.	S. Ste. Marie, Ont.	S. Ste. Marie, Ont.	Billets, blooms, rails, fastenings.
Swedish Crucible Steel Co. of Canada, Ltd.	Windsor, Ont.	Windsor, Ont.	Castings.
Manitoba Rolling Mills Co.	Winnipeg, Man.	Winnipeg, Man.	Bars.
Alberta Rolling Mills Co.	Med. Hat, Alta.	Med. Hat, Alta.	Muckbars.
The Redcliff Rolling Mills & Bolts Co.	Redcliff, Alta.	Redcliff, Alta.	Bars.
Swedish Crucible Steel Co. of Canada, Ltd.	Windsor, Ont.	Windsor, Ont.	Castings.
Manitoba Rolling Mills Co., Ltd	Winnipeg, Man. Box 2904	Winnipeg, Man.	Bars
Alberta Rolling Mills Co.	Medicine Hat, Alta.	Medicine Hat, Alta.	Muckbars.
The Redcliff Rolling Mills & Bolts Co.	Redcliff, Alta.	Redcliff, Alta.	Bars

The grain crop of Canada—the largest she has ever harvested—is now slowly filtering into transportation channels for shipment to Britain. Other agricultural products are also being turned into cash, but during the past spring and summer, while the crops were growing, Canadian exports increased in volume at a rate never before experienced in the history of the country, and largely as a result of the embarkation of this country in the supplying of munitions, due primarily and possibly only, because Canada had built up a steel industry, relatively small, it is true, but sufficient for the moment, and this because some Canadian statesmen and the pioneers of the industry had builded better than they knew. The Dominion will during the next fifteen months probably export to Great Britain munitions aggregating in value not less than two hundred and possibly three hundred millions of dollars, fully eighty per cent. of which will be wholly the product of Canadian labor—coal miners, iron and steel workers, machinists, and others working in the engineering shops of the Dominion.

We have spoken of the volume of this munition work as being between $200,000 and $300,000,000. This is a wide variation. The uncertainty in regard to the amount resolves itself into a question of Canada being able to obtain either from her domestic furnaces or elsewhere sufficient steel for shell forging, for there is no doubt that the engineering shops of Canada can overtake the assembling and finishing of shells of the value of more than $300,000,000 if the steel can be secured.

Steel Ingot Production

The year 1913 marked the greatest production of steel ingots by Canada in that country's history, when the total output of all the furnaces in the Dominion was 1,048,538 tons, while during the year 1914 the output dropped to 775,000.

Little has been added to the steel production capacity of the Dominion since the close of 1913, and it is doubtful if Canada during 1915 will even by straining all its resources produce 1,100,000 tons.

Assuming new equipment is added, as it probably will be, to a moderate extent, we may, therefore, look for under the most favorable conditions a total output of not more than, say, 1,250,000 tons of steel ingots.

Turning now to the United States, an extraordinary situation at present prevails. Never in the history of that country has the demand been so great. Difficulty in securing steel of every description has developed rapidly during the past few weeks, and there are at present many signs of excitement in the iron and steel trade.

During the month of October last the United States production of pig iron for the first time on record exceeded 3,000,000 tons (i.e., 3,125,491), exceeding that of September of this year by more than 95,000 tons, and being almost double that of the corresponding month of 1914, when the daily output was 51,000 tons.

The amazing consideration is that, while the United States to-day is producing pig iron at the unprecedented rate of 37,500,000 tons a year, prices are advancing daily. The advance in prices in the first week of November was 50 cents a ton on coke iron and $1 a ton on charcoal iron, while basic iron has during the year advanced from $12.50 to $15.80 a ton.

Demand For And Price of Steel

So far as steel is concerned, the demand and increase in price is even greater than in the case of pig iron. Indeed, the situation is unique as regards price of finished steel, and at present it is difficult to find a seller who can make deliveries.

Eastern and Western mills are alike congested with business, and in but a few cases it is possible to find mills having any open capacity.

Plate mills are filled up with car, locomotive and shipbuilding tonnage. The railways, which were almost entirely absent from the market for many months past, have recently given out orders for a large quantity of rails, while about 300,000 tons, it is understood, have been booked for export within the coming two months to Russia.

During October the American railways also bought more than 27,000 cars, and probably more than 10,000 have been booked for export to the Russian Government.

As regards steel plates, the increase in price and difficulty is even greater, and the suggestive fact is that, notwithstanding these great advances in price, it has failed to shut off demand in the least, and in most lines it is not now a question of price, but where to find a mill that will undertake to guarantee deliveries. While the situation as regards structural steel is grave, it is in forging billets that the situation is most acute.

Steel bars in November, 1914, sold in Pittsburg at $1.10, while in November of the present year the price was $1.50, or a 36 per cent. advance; while in forging billets the difference was much greater, the figures being $25 and $42 respectively, or an advance of 68 per cent. Indeed, high carbon steel sold in large quantities at previously unheard-of prices, even during the closing days of October, orders aggregating more than 60,000 tons of high carbon forging. Billets were reported as placed at prices as high as $56 per ton, Pittsburg. Further, it is stated that the British and Allied requirements for high carbon shell steel alone—which are now becoming insistent —will total up the enormous figures of 20,000,000 tons.

It is, therefore, clearly evident that Canada and the United States will, during the coming year, face a steel famine unprecedented in the history of this continent.

The outcome will be as interesting as it will be far-reaching, and it will probably interfere more or less effectively with some of the profits so easily shown on paper as capable of being earned by munition plants yet unbuilt and dependent upon actual iron and steel producers for their raw material.

It should also provide a moral to the country at large to build up what is one of the most fundamental national assets—a strong, well-rounded and self-dependent iron and steel industry.

This article was prepared in the first instance for presentation before the Montreal Metallurgical Society, and the name of its author is sufficient guarantee not only of accuracy of detail, but of painstaking thoroughness in tracing the Canadian iron and steel industry from its inception up to date.

INDUSTRIAL ACTIVITY BECOMING GENERAL

THE Canadian Bank of Commerce has begun the publication of a monthly commercial letter, through which customers and correspondents of the bank will be regularly apprised of the condition of foreign and Canadian trade. The initial report, dated this month, treats of recent agricultural and manufacturing progress in an interesting and authoritative fashion. On the situation of trade generally the report speaks in this encouraging way:

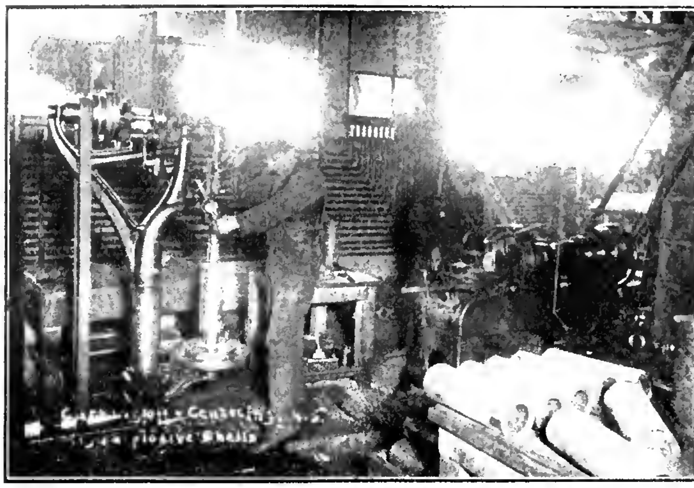
"Industrial activity is becoming more general throughout the Dominion. Lumber mills are encouraged by the lower stocks at distributing yards on the prairies and by the increasing demands from the Eastern States.

"Paper makers and pulp mills are, generally speaking, quite active as a result of better demands from the United States. Prices are slightly higher on new contracts, and the outlook is regarded by the trade as being exceptionally bright.

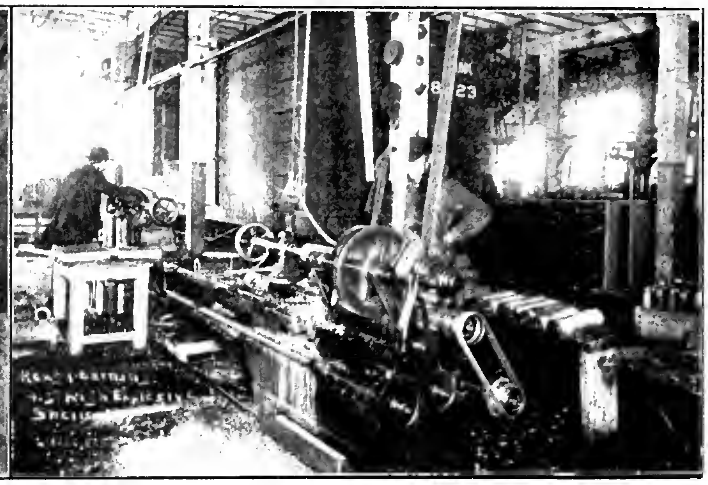
"Textile plants are not only employed to a very large extent in filling orders for military purposes, but they have on their books orders for domestic requirements in quantities which denote more normal demands. Their chief trouble for the time being is in procuring raw materials and dyes.

"A scarcity of steel suitable for certain classes of ammunition and the very high level of prices for all metals are causes of some apprehension in certain lines of industry."

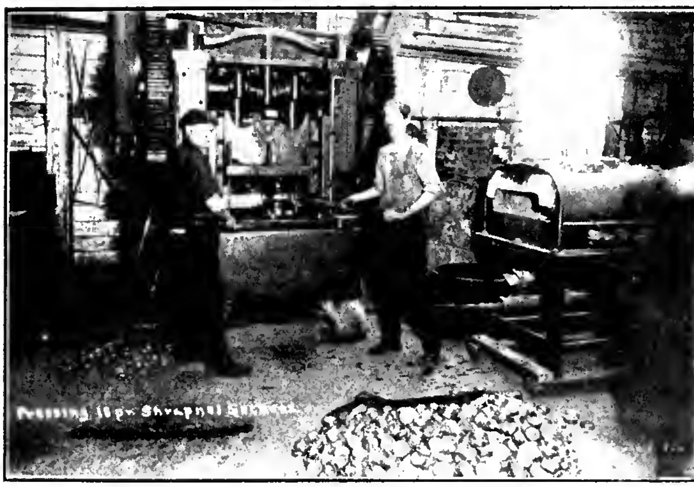
Typical Departments in Canada's Shell-Making Plants



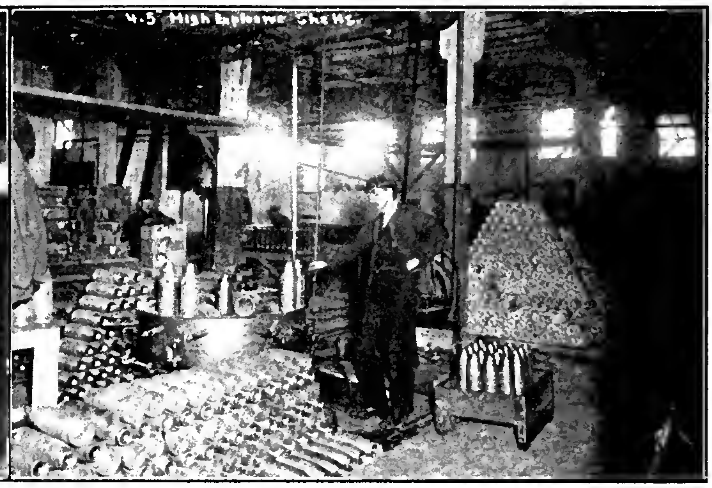
CUTTING OFF AND CENTERING 4.5 IN. H. E. SHELLS.



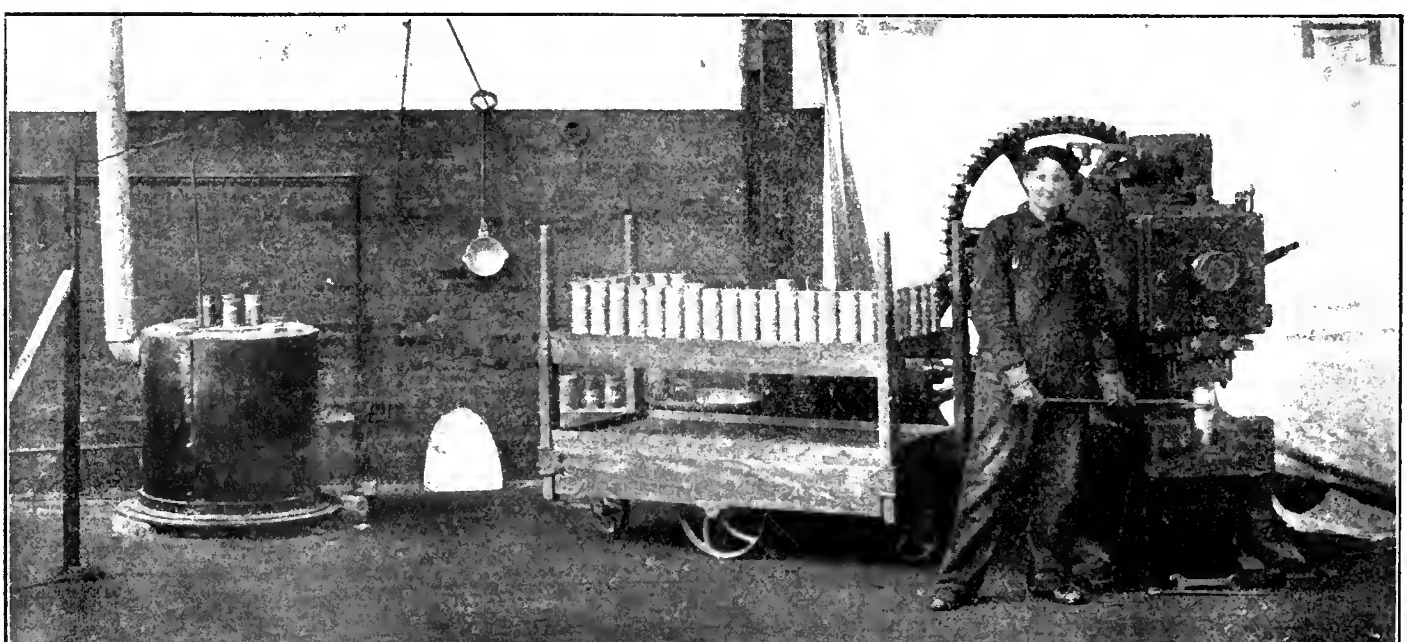
ROUGH TURNING 4.5 IN. HIGH EXPLOSIVE SHELLS



FORGING BRASS SOCKETS FOR SHRAPNEL IN A POWER PRESS.



PRESSING ON COPPER DRIVING BANDS BY HYDRAULIC POWER



OIL-FIRED LEAD BATH FURNACE AND POWER PRESS FOR FORMING NOSE ON SHRAPNEL.

High Explosive Shell Manufacture

STAFF ARTICLE

As in the manufacture of 18-pdr. shrapnel and 3.3 high explosive shells, a widely diversified industrial enterprise found opportunity to exhibit inventive genius and apply it to secure high quality and quantity output, in like manner we find in the production of the larger size high explosive shells that equally satisfactory achievements is being attained.

BUILDING CONTRACTORS MAKE 4.5-IN. SHELLS

PREVIOUS to the outbreak of the war the plant here described was wholly employed on large building contracts. Realizing, however, the necessity and advisability of co-operating with the Shell Committee in the manufacture of munitions, it was decided to rearrange their carpentry shop and install the necessary equipment for the machining of 4.5 high explosive shells.

At first the shell forgings were received from outside sources, but latterly a forging department was added (a section of the large stone shop being utilized for this purpose), and now the shells are being made complete from the billet. The various operations and their purpose constitute the substance of the data that follows:

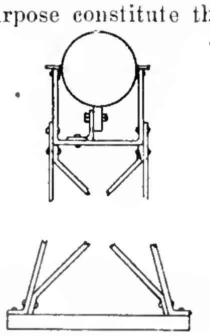


FIG. 2. SECTION OF BILLET CONVEYOR.

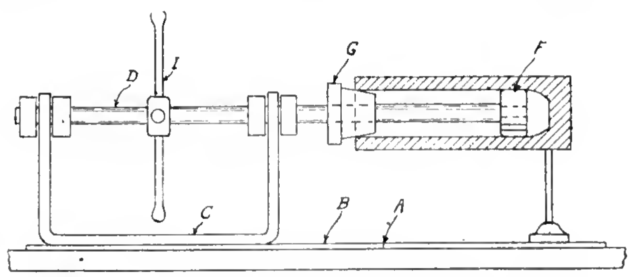


FIG. 3. GAUGE FOR SHELL WALL THICKNESS.

Receiving the Billets

The billets from which the forgings are made are received in carload lots from the steel foundry where the steel is made and cast into ingots preparatory to being cut into billets of the required dimensions.

Each billet has stamped on it the number of the heat or melt from which it was made, also the carbon content is plainly marked. The billets are carefully sorted, according to heat numbers, so that test pieces from two shells of each heat may be selected for test, according to specifications. As a carload may contain quite a few heat numbers, the work of separating and arranging the billets frequently assumes considerable dimensions, as any carelessness or neglect leads to complications at a later stage, which give considerable trouble.

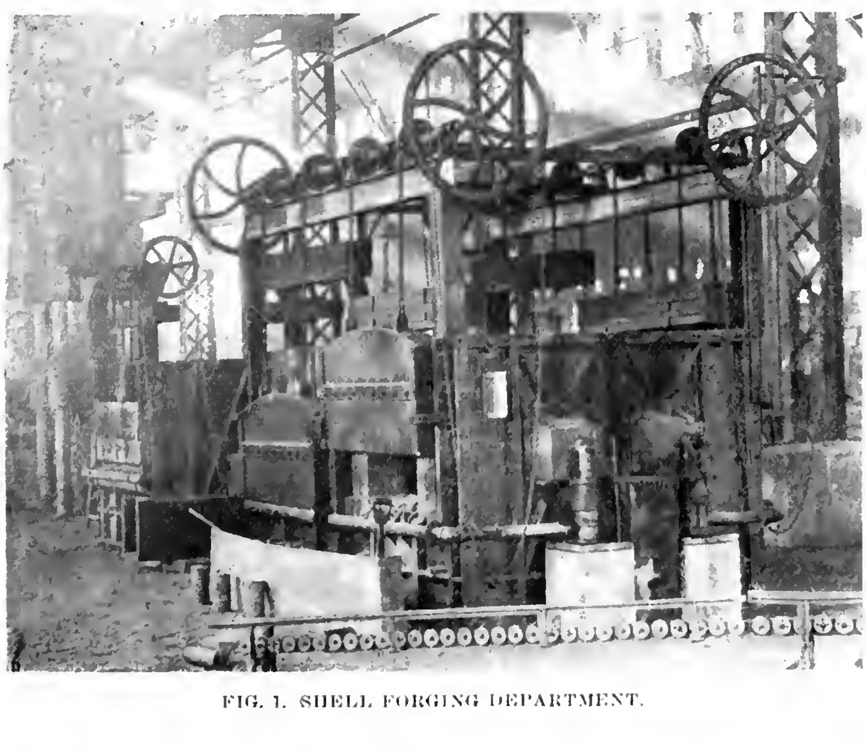


FIG. 1. SHELL FORGING DEPARTMENT.

To facilitate the handling of these billets from the car to the shop floor, the carrier shown in the foreground of Fig. 1 is used; this can be placed to transfer the blanks to any desired position. These carriers were supplied by the Canadian Matthews Gravity Carrier

Co., of Toronto; a section of this device is shown in Fig. 2.

Forging Department

When the billets have been examined and placed in piles, they are ready to be heated for forging. The forge department shown in Fig. 1 contains two double and two single oil burning furnaces, made by the Mechanical Engineering Co., and one 350-ton and one 200-ton hydraulic presses installed by the Southwark Foundry and Machine Co., of Philadelphia. These presses are operated by two hydraulic pumps, in conjunction with an accumulator. One of these, a direct-driven pump, was supplied by Dean Bros., of Indianapolis, and the other, a belt-driven pump, was installed by the Deane Steam Pump Co., of Holyoke.

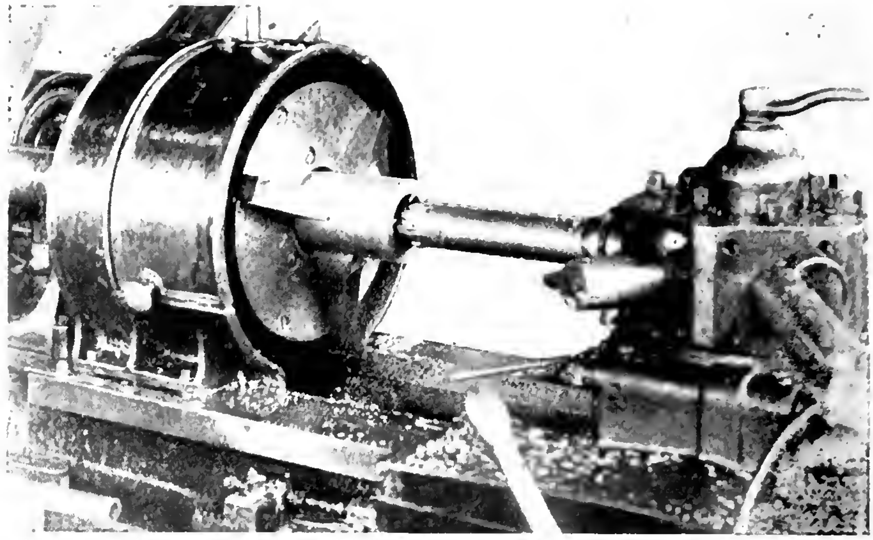


FIG. 5. CLOSE VIEW OF INSIDE BORE MACHINING OPERATION.

Heating the Blanks

Each furnace chamber contains a charge of about 60 billets, which requires a couple of hours to heat. When the blanks have been heated to about 2,200° F., they are ready for forging. The door of the furnace is then opened and an operator removes one of the hot billets with suitable tongs, which are suspended by a chain from a small trolley car which travels on an overhead rail from the front of the furnaces to the presses.

Drawing the Shell

The billet is placed on a metal-covered table, where two men with scrapers remove the scale. This scale must be thoroughly removed to insure clean shells and prevent wear to the punch and die. When the blank is quite free from scale, it is placed in the die (which has previously been swabbed with graphite and oil), a small quantity of coal dust thrown on the top, and the ram forced downward, which causes the punch to enter the billet, and as the punch proceeds downwards, the metal flows (in a solid state) upwards around the punch. When the punch has completed its work, the ram is raised to its upper position. As the ram goes up, a cross bar below the die, connected to the ram by two chains, comes in contact with the knock-out, which forces the finished shell from the die. The shell is then removed and placed in piles, care being still taken that billets of different heat numbers do not become mixed.

Allowing for all ordinary changes and repairs, an average output is maintained of 40 an hour on the large press and 35 an hour on the smaller press during the twenty-four hours.

While the charge of billets from one furnace is being forged the blanks in the other furnace are being heated.

When the plans of installation were being considered it was decided to place the furnaces in the position shown, as this arrangement prevents the heat of the fires from striking the press operators when the furnace doors are opened.

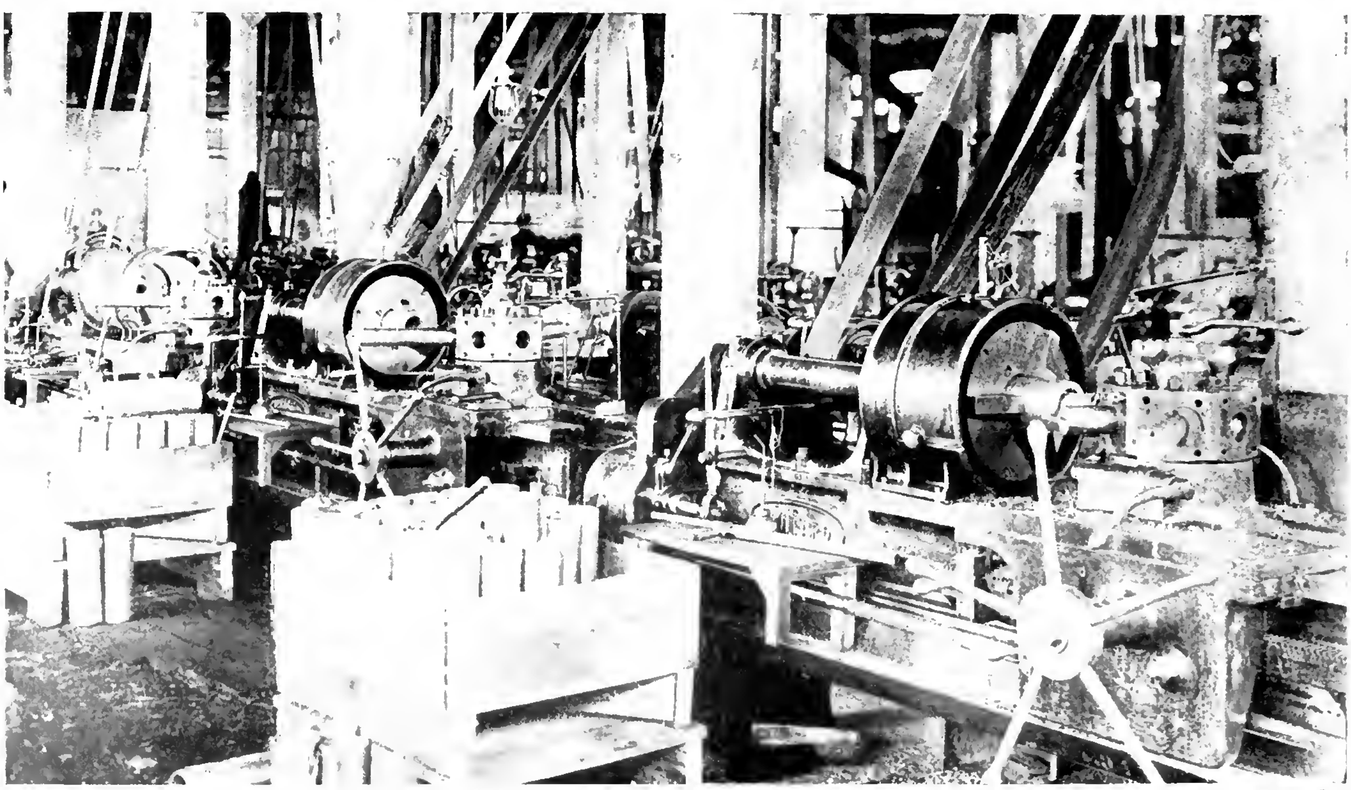


FIG. 4. GROUP OF "SINGLE PURPOSE" LATHES MACHINING INSIDE OF SHELLS.

Rough Shell Inspection

After the shells have cooled, they are inspected for defects and gauged for length and concentricity of internal and external diameters.

The gauging device in use is shown in Fig. 3. The U-shaped piece C is secured

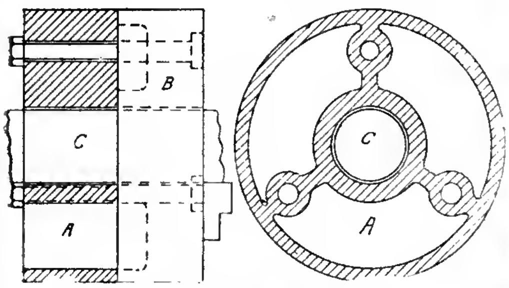


FIG. 6. CHUCK EXTENSION PIECE FOR INSIDE BORE MACHINING.

to the plate B on the bench. On the shaft D is a three-point fixed collar F and a movable collar G, tapered to enter the mouth of the shell. When the shell has been placed on the shaft it is revolved by means of the handle I, and the length of the gauge is such that useless shells are very readily detected.

Cutting Off and Centering

The first machining operation is cutting off the open end and facing the base to the required length. This is accomplished on three Hall cutting-off machines, the output of each machine being between 110-115 in ten hours.

To centre the base, the shell is placed on a mandrel held in the spindle of a small lathe and the centering drill forced in from the tailstock spindle. Owing to eccentricity of the wall thickness it is sometimes found that this centre would not allow the outside diameter to finish to the desired dimensions. When this trouble arises the centre is drawn over and a special boring operation is performed to rough out the inside.

Rough turning the outside diameter is done in four Lodge & Shipley 22-in. engine lathes, the open end being forced on a short tapered arbor, with inserted cast steel hardened pieces, serrated on the edges to drive the shell, while the base is supported by the tailstock centre. One roughing cut is taken over the entire length, and each machine has an output of about 110 shells in ten hours, lubricant used on machining operations being Economic water oil and Justrite cutting compound. This removal of stock from the rough shell allows the forging strains to readjust themselves and re-

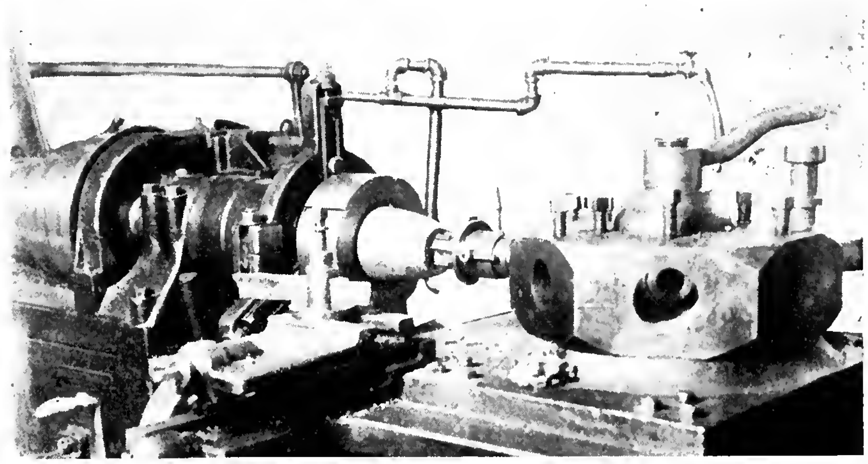


FIG. 8. BORING, RECESSING, FACING AND THREADING SHELL NOSE.

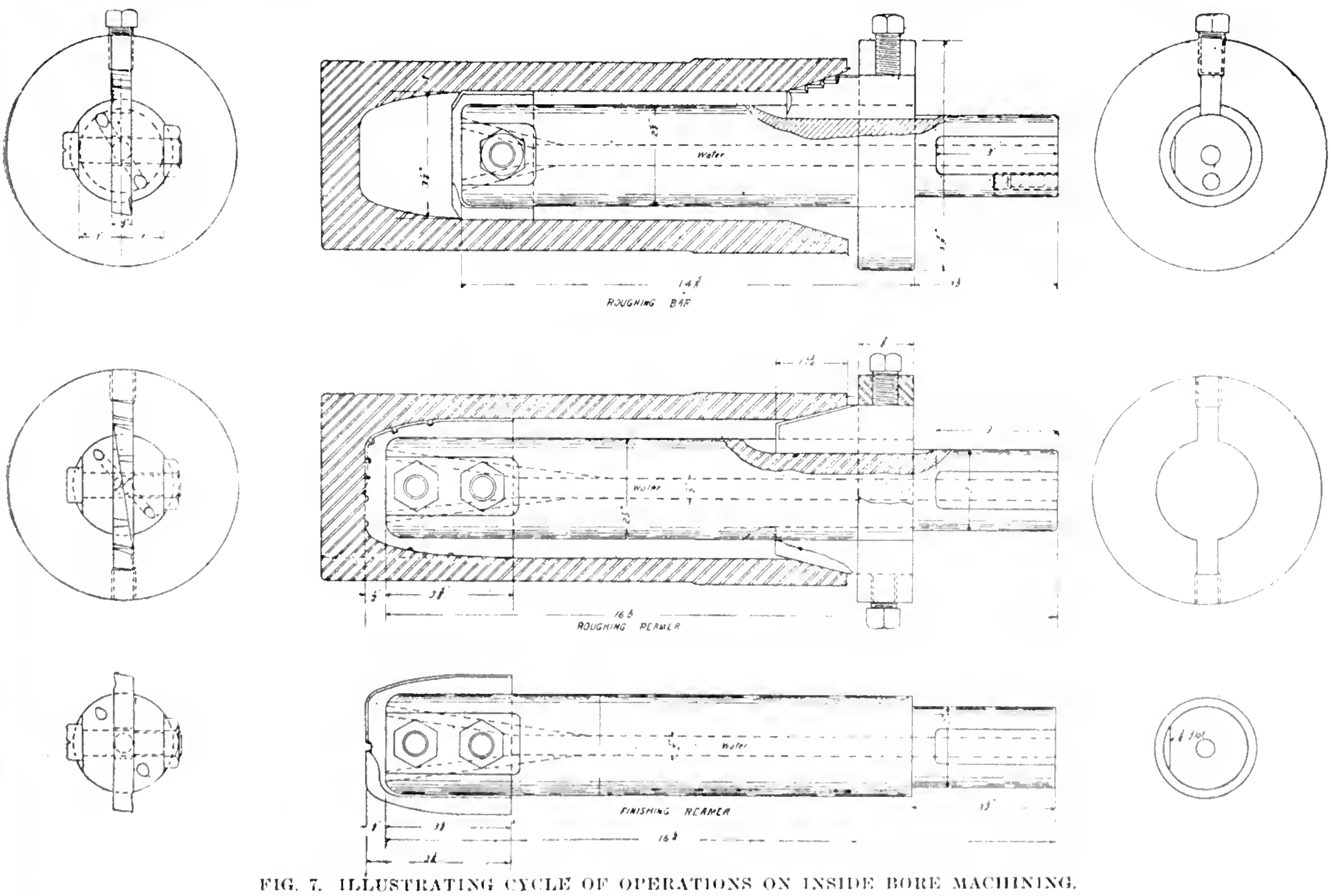


FIG. 7. ILLUSTRATING CYCLE OF OPERATIONS ON INSIDE BORE MACHINING.

duce the possibility of subsequent warping.

Machining Inside Bore

The machining on the inside bore is accomplished on seven Bullard single

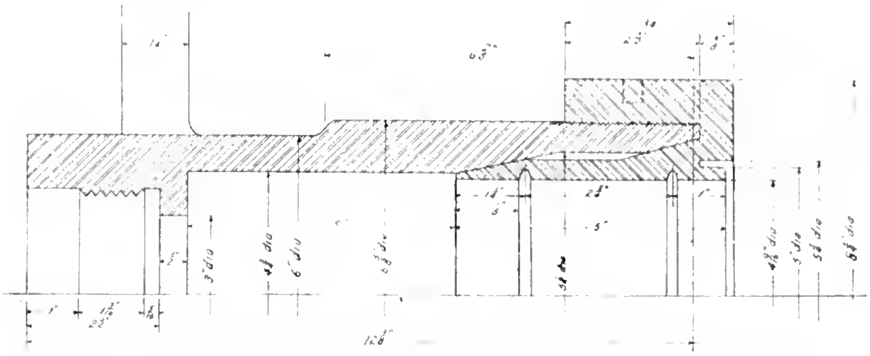


FIG. 9. POT CHUCK USED WHEN BORING, RECESSING, FACING AND THREADING SHELL NOSES.

purpose projectile lathes, a group of which are shown in Fig. 4. These machines are driven by 6-inch Balata belting. A closer view of the operation is seen in Fig. 5. To avoid the use of a steady head and retain rigidity during the machining of the bore, an extension piece was placed at the back of the chuck and secured to the face plate.

A sketch of this is shown in Fig. 6. The piece A, which is cored out to eliminate weight, is bolted to the chuck as shown, and also to the face plate on the lathe; it is then bored out a free fit for the rough turned shell.

The cycle of operations is shown in Fig. 7; roughing ing the bore and roughing out mouth of shell; roughing out base contour and finishing open end; finishing bore and base contour. An average production of 70 to 75 shells a day of ten hours is maintained on each machine.

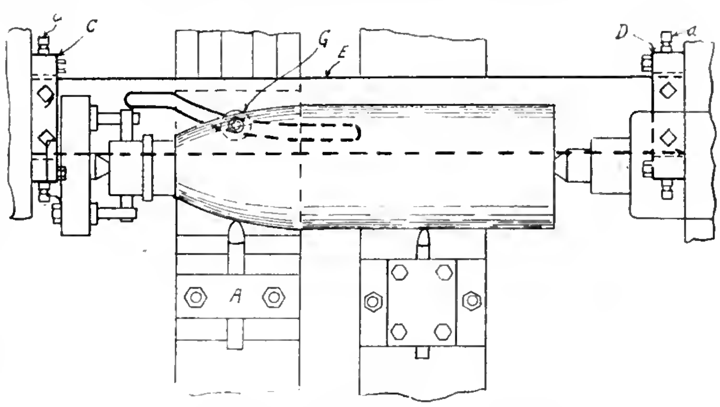


FIG. 11. PROFILE FORMING ATTACHMENT.

Forming the Nose

When the shells have been finished on the inside, they are taken to the nosing department, where the open ends are placed in holes in the face of a furnace and heated to a temperature of about 1,600° F. There are two of these furnaces, one constructed by the Peter Lyall & Sons Construction Co., and one installed by the Strong, Carlisle & Hammond Co. In the heating of the shells for nosing, much depends upon the skill and experience of the man in charge of the fire, as the shell must be heated to a certain distance from the open end to obtain the best results; a careless or inexperienced heater may be the cause of an undue quantity of rejected shells. Heating too far down the shell will allow the metal at the lower end of the profile to yield under the pressure, and the opening at the nose may not be small enough. On the other hand, when the amount heated is short of that required, the pressure upon the die when shaping the shell may become so great as to result in a cracked or damaged die.

When the shell blanks have been heated in the required manner, they are placed in a hydraulic press and the mouth of the shell formed to the shape desired. The forming die is made of cast steel, hardened, and enclosed by a water jacket, which prevents the die from being over-heated. The two presses working on this operation were supplied by W. R. Perrin, of Toronto, who also supplied the pump and accumulator. The daily output of this department is over 600 shells in ten hours.

Threading Inside Nose

Four lathes are operating on boring, threading and finishing the nose; two C. M. C. 20-inch engine lathes and two Edwin Harrington, Son & Co. 18-inch gap lathes. All these lathes are fitted with special turrets, designed and constructed in the shop. They are very rigid, showing no vibration during operations. On the two last-mentioned lathes these turrets can be placed on the saddle without interfering with the present cross slide tool support.

The sequence of machining on this operation is boring, recessing, facing and threading; the latter being done with Murchey collapsible taps. The chuck used on this operation is shown in Fig. 9 and is self-explanatory. Output on each machine is about 150 shells in ten hours.

Inside Nose Contour

Contrary to the general method of forming the inside nose contour during the above operation, this is done on an old Jones & Lamson turret machine, where the inside profile is formed at the rate of 30 an hour. This operation is to clean up and remove any inequalities (caused by the formation of the nose in the hydraulic press) and to insure perfect concentricity with the rest of the bore. This is necessary to insure the shell being in perfect balance.

Finish Turn and Profile

A special driving plug is now screwed into the threaded nose and the shell placed between centres to have the outside diameter and nose profile finished.

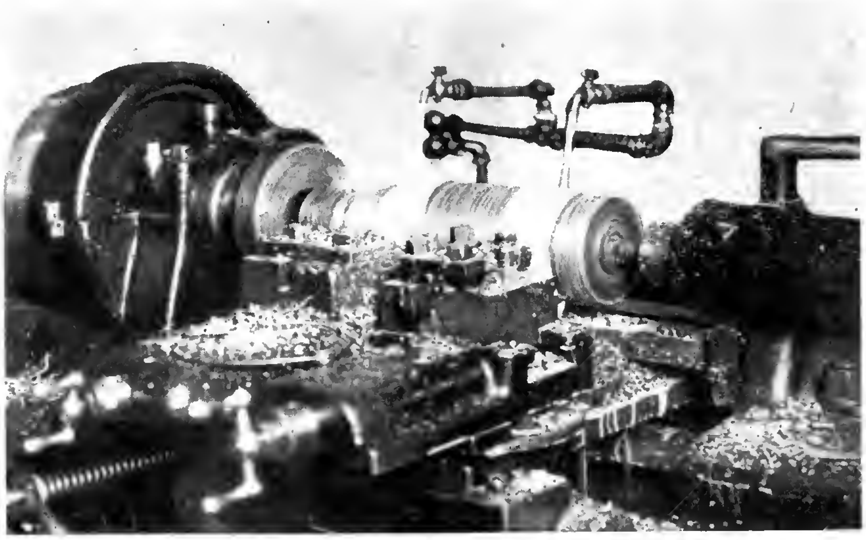


FIG. 10. "WALCOTT" LATHE, FINISH TURNING AND PROFILING SHELL BODIES.

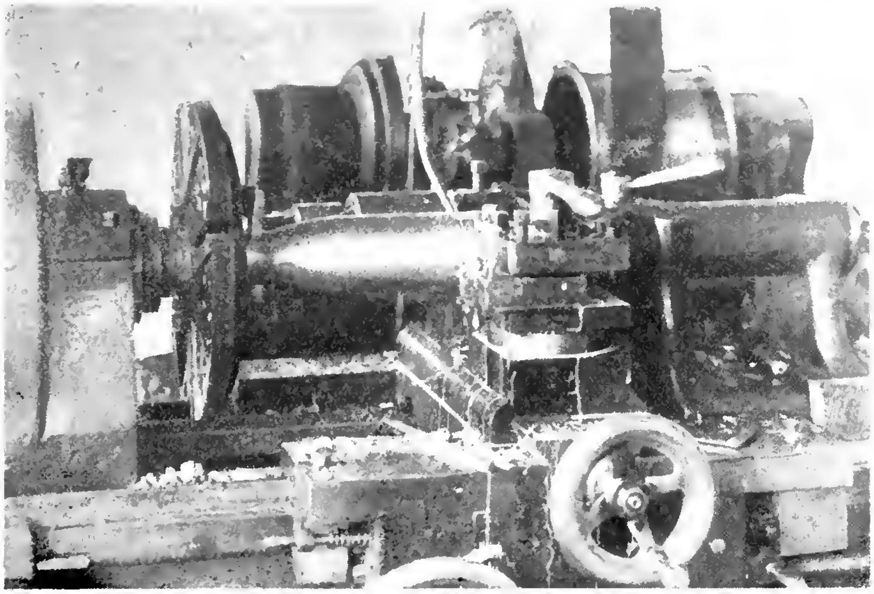


FIG. 12. GROOVING AND WAVING FOR COPPER BAND.

Four 20-in. engine lathes are used for this operation—two Greaves Klusman and two Walcott; a view of the latter in operation is shown in Fig. 10, with two tools working, one on the parallel portion and the other on the contour. This method of using two tools increased the output from 85 to 125 shells in ten hours.

Fig. 11 shows a sketch of the profile forming device (in heavy lines) as applied on these lathes. The movement of the cutting tool A is controlled by the roller G in the cam slot, cut in the bar E, which is secured to the brackets C and D, fastened to the headstock and tailstock respectively; adjustment of the cam plate is easily and quickly obtained by means of the set screws (a).

At this stage the shells are examined and weighed and usually found to be slightly overweight. This excess stock is faced off the base; the approximate amount to be removed being about 1-64 of an inch per ounce excess.

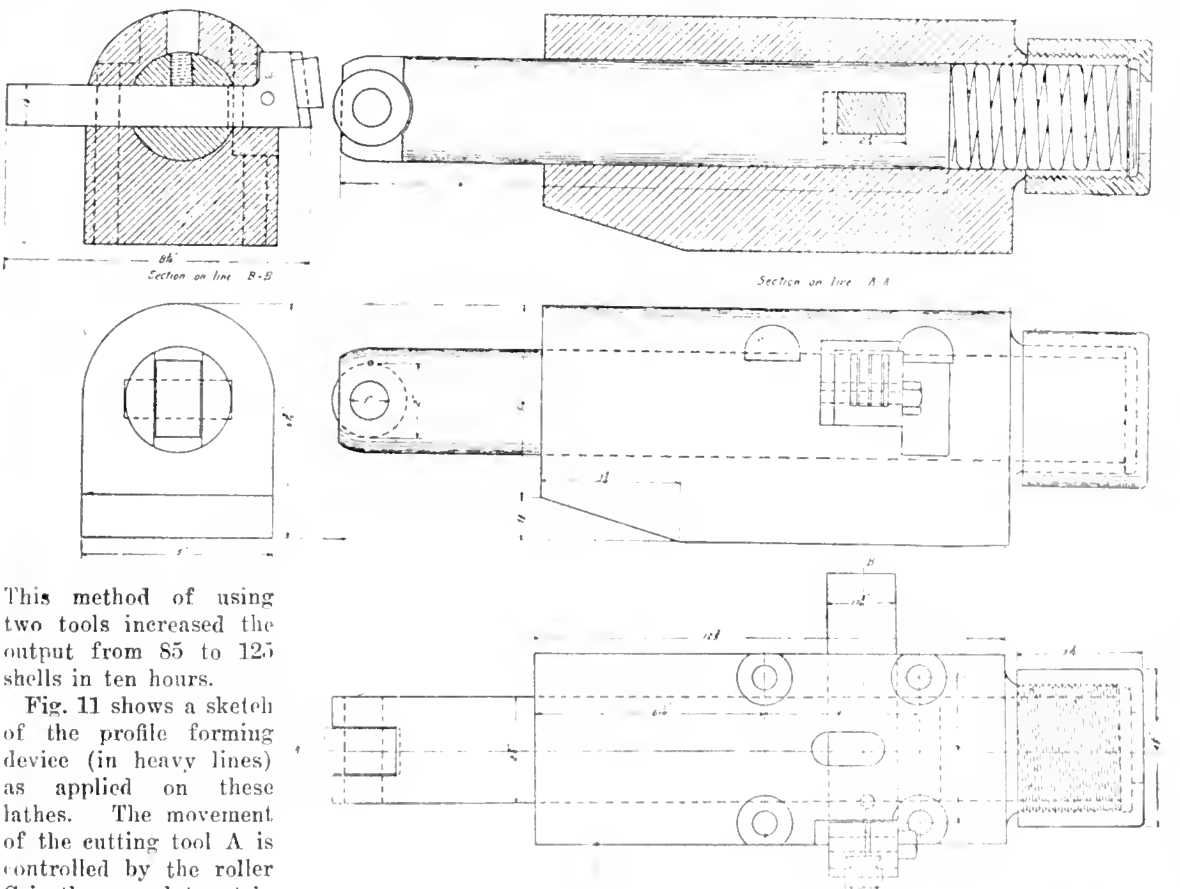


FIG. 13. DIAGRAMMATIC REPRESENTATION OF WAVING DEVICE.

Groove and Wave

The grooving and waving to receive the copper band is performed on two 20-inch engine lathes, manufactured by the Norwood Engineering Co., of Florence, Mass. These lathes are fitted with special waving attachment, designed by the shell shop superintendent and constructed in the shop. The output on this operation is 125 shells in ten hours from each machine. The construction of the waving device can be more clearly understood by referring to Fig. 13.

These waving ribs are then notched in three places with a cold chisel to allow the escape of air when the copper band is being pressed on. The ribs are triangular-shaped, so that in the closing of the copper band, under compression, the pointed ribs will cut their way into the copper freely. Close adherence to specifications, both in forming the groove and pressing on of the band is essential, as very careful inspection is given to this detail.

Recessing the Base

Three Bullard single purpose machines are used for cutting out the recess to receive the base plate. A view of this operation is shown in Fig. 14. This view with the chuck guard thrown back gives a better idea of the chuck extension shown in Fig. 6.

Two methods of inserting this base plate are now being used—screwing and riveting: the latter at present being more generally adopted. Each machine is recessing about 150 shells in ten hours.

The base plates are finished in two Greaves Klusman 20-inch engine lathes.

Riveting in Base Plates

Fig. 15 is a view of the operation where the base plates are riveted in and faced off. Two C. M. C. 18-inch engine lathes, fitted with special chucks, are used on this operation. While the cutting tool is facing off the base plate from the rear (the lathe running backwards),

the Independent Pneumatic riveter is operating on the opposite side of the disc. One man on each machine faces off and rivets 150 in ten hours.

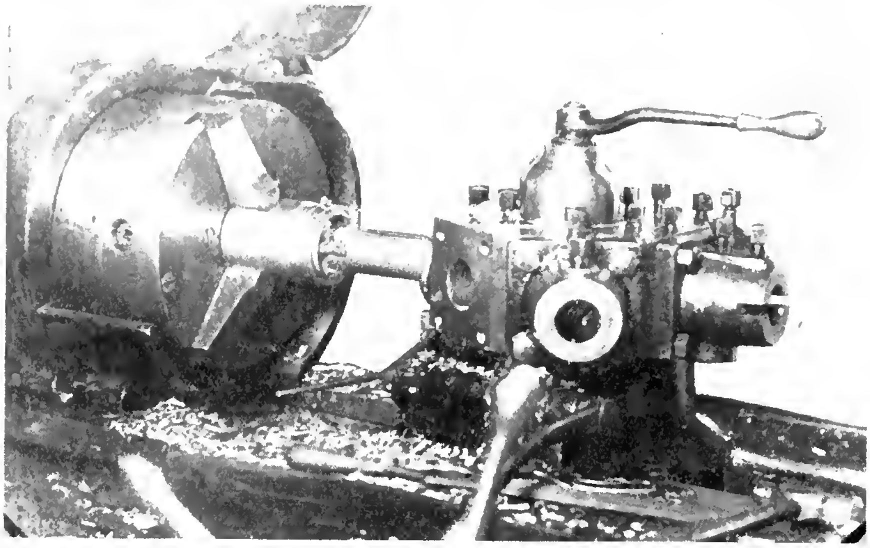


FIG. 14. SINGLE PURPOSE LATHE RECESSING SHELL BASES.

Purpose of Base Plate

The uninitiated may wonder why the metal at the base of the shell is first taken out and a plug inserted in the space, for no apparent reason. However, in the general construction of high explosive shells this feature is one of the most important. During the process of casting the ingot and forging the shell there are always possibilities of the formation of pipes and flaws. When the gun is discharged the propelling gases exert such a pressure on the base of the shell that any defects at this point might allow these gases to penetrate the metal and ignite the explosives contained in the shell, causing a premature bursting of the shell, and possibly destroy the gun and injure the crew.

For this reason a disc of close grained forged steel is inserted in the base of all high explosive shells of the smaller sizes.

Fitting and Machining Brass Socket

The brass or steel sockets—which come to the shop in a semi-finished state are now screwed firmly into the nose of the shell. This is accomplished by chucking the shell in an old lathe, and by means of a special jig the bush or socket is forced home. The jig is threaded on the outside to fit the bore of the bush. Through the middle of the jig is a slot which contains a tapered key, and back of this slot is a square to fit a suitable wrench.

To put the bush in, the jig is screwed into the socket and a threaded collar comes in contact with the bush. This collar is backed up by the tapered plug, which prevents the collar from turning. When the socket has been screwed firmly into place, a sharp tap on the small end of the locking pin releases the device and the jig is easily removed.

The sockets are finished turned (to conform with contour of nose) on an old engine lathe, fitted with a special head on the saddle, carrying a form cutter.

Pressing and Machining Copper Band

After the small hole (for the screw that secures the time fuse) has been drilled and tapped, the shells are taken to the banding machine, where the copper bands are pressed on. This is performed on a Lymburner hydraulic press receiving power from a pump of the same make.

FIG. 16. PAINTING SHELL BODIES.

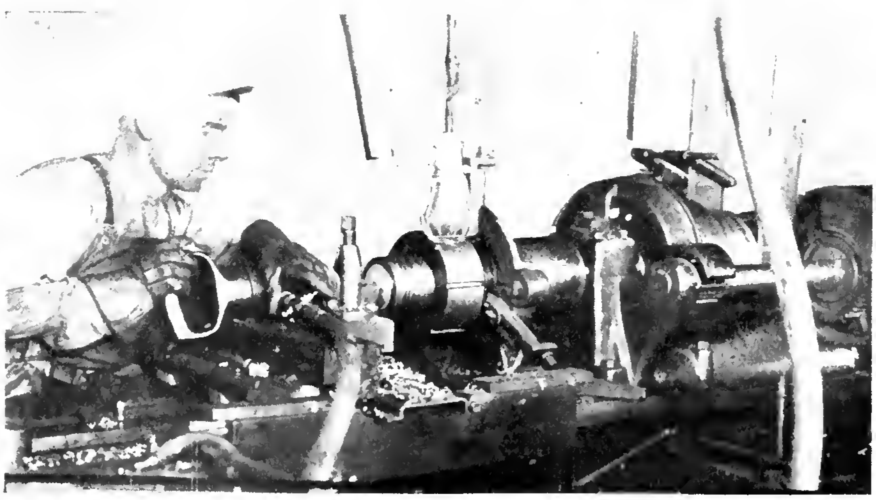


FIG. 15. RIVETING-IN SHELL BASE PLATES.

The copper bands are now finish turned to the desired form on a Jenckes band turning lathe, fitted with a special chuck, operated by compressed air. The cycle of operations are the placing of shells in the chuck; locating with a stop gauge; closing chuck; removing stop; turning band; removing burrs with hand scraper; releasing chuck; removing shell and gauging the band. An average output of from 90 to 100 per hour is maintained. On test, a production of two finished bands a minute has been done on this machine. The finished dimensions and profile of the copper band must

conform to the specifications as closely as possible.

Varnishing the Interior

The shells are now heated for about half-hour to a temperature of 250° F. in two special gas furnaces constructed by the P. Lyall & Sons Construction Co.

When sufficiently heated, the shells are transferred to a bench, where the internal surface is sprayed with varnish by using a sprayer made by the Paasche Air Brush Co. After varnishing, the shells are placed in an electric oven for about an hour to thoroughly dry and harden.

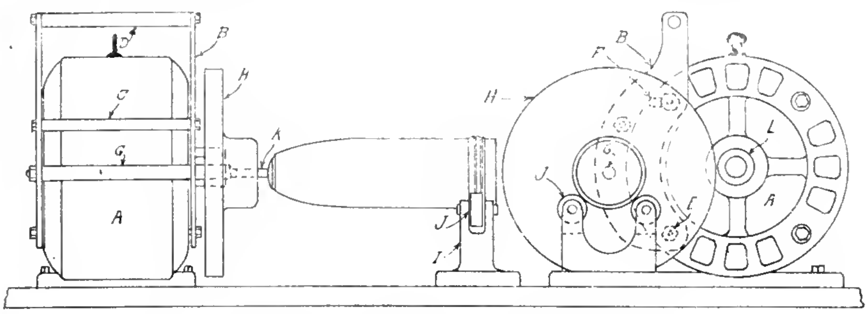


FIG. 17. DETAIL OF SHELL PAINTING DEVICE.

Each shell is now closely examined by Government inspectors, when all doubtful shells are set aside, and if these cannot be corrected to meet the specifications, the shells are rejected. The factory inspectors have become so thorough in their work that very few of the shells submitted to the Government examiners are rejected.

It might be well to state that the varnishing of the shell interior is a very important detail, and a smooth, clean, dry surface, free from cracks, flaws and other imperfections, is necessary, as the action of the explosive charge is very destructive to exposed metal.

Interesting Painting Device

A very interesting and productive revice is used in this plant for painting the outside of the finished shells. This arrangement is shown in Figs. 16 and 17. The power is derived from a ½-h.p. Thompson motor. On either side of the motor A are the plates B, held together by the stay rods C and D. This frame work is hinged at the stud E. On the shaft G is secured the wooden disc H and the chuck shown, which carries the driving pin K, squared on the end to fit the hole in the plug.

The bracket I is secured to the bench in such a position that the rolls J support the shell at the copper band, allowing access to all parts of the shell to be painted.

The shell is placed on the device with pin K in position and the frame B forced over with the left hand, bringing the discs H and L in contact, thus revolving the shell. The slot F prevents the frame from falling away from the motor.

Crating and Loading

When the paint has thoroughly dried, the shells are again inspected and crated, two in a box, in readiness for shipment. This last operation being performed on the second floor, the arrangement shown in Fig. 18 was constructed to facilitate handling of the crates from the shop to the car.

In line with the top of a bench A an opening was made in the brick wall and the shoot C supported as shown. The piece D, which is hinged at the base of the shoot, is supported by the brace E in such a position that the velocity of the case is reduced as it is received into the car. The piece D can be dropped clear of the track when the car is loaded. The present output is a carload of about 4,000 shells a week.

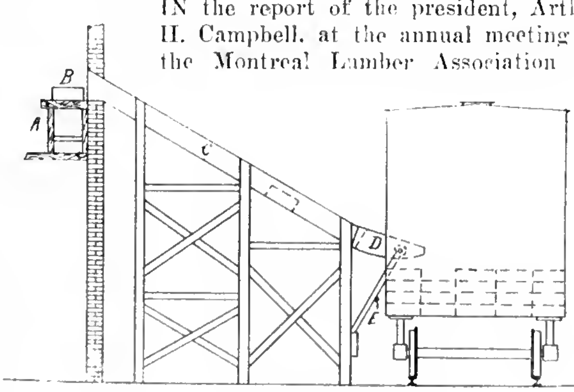


FIG. 18. SHIPPING THE SHELLS.

PORT OF MONTREAL LUMBER EXPORTS

IN the report of the president, Arthur H. Campbell, at the annual meeting of the Montreal Lumber Association recently, reference was made to the fact that, in spite of the very high ocean freight rates on lumber as a result of the scarcity of ocean tonnage brought about by the war, the exports from the port of Montreal will probably be found when the figures for the season are finally compiled, to have been quite as large as last year's. The demand has been chiefly for lumber such as spruce, and hard woods for the manufacture of cases and crates for war purposes.

The president referred at length to a large number of important matters in connection with railway transportation, chief among them being the proposed advance in railway rates on lumber in the territory east of Port Arthur, the last hearing in connection with which was held by the Board of Railway Commissioners on 30th June, no decision, however, having yet been rendered by the Commission. The association had strenuously opposed any increase in the railway freight rates on lumber.

CANADIAN ECONOMIC AND DEVELOPMENT COMMISSION

THE Economic and Development Commission, which has been in session in Ottawa during the past week, has adjourned to meet again in Ottawa the latter part of January, when it is expected that a very considerable mass of information bearing on its work will have been collected. The Commission is desirous of securing information on all matters within the wide scope of its inquiries, and invites communications from all authorities or experts dealing with such subjects as:

The collection and publication of accurate and reliable statistics relative to the agricultural production of the Dominion;

The inauguration of some comprehensive plan whereby farmers may obtain more readily and less expensively than at present long and short credits for the carrying on of farm operations and the further development of their resources;

The application of the principle of Government control to public markets, stock yards and other like utilities;

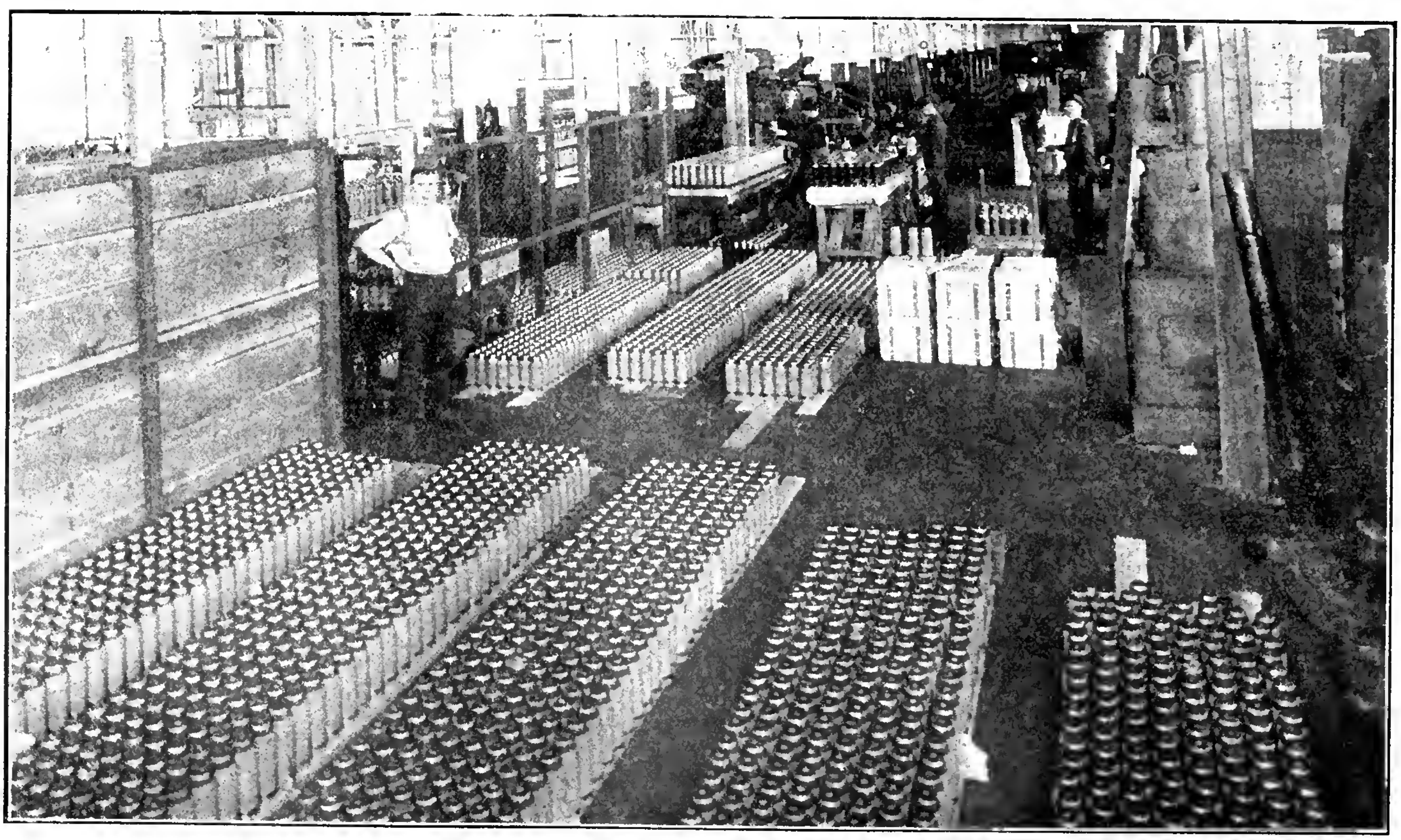
The whole question of co-operation in connection with the production, marketing and consumption, and the advisability of securing simple and uniform legislation providing for the establishing and management of co-operative societies;

The question of settling the vacant lands of Canada, and the future policy respecting immigration and colonization in this connection.

The Commission invites the hearty co-operation of the Canadian public in the work which it has in hand. Any person desirous of presenting written statements or appearing personally before the Commission will be accorded every reasonable opportunity of so doing. Communications should be addressed to the Secretary, 22 Victoria street, Ottawa.

Typical Departments in Canada's Shell-Making Plants

SCENE IN PAINTING DEPARTMENT WHERE SHELLS RECEIVE FINAL TOUCHES BEFORE SHIPPING



COMPLETED SHELLS, INSPECTED AND PAINTED, READY FOR BOXING AND SHIPPING.

Low Level Pumping Station, Montreal City Waterworks

Staff Article

The origin and development of this plant, which supplies the greater portion of Canada's metropolis with water for domestic and other purposes, is not only interesting, but serves to indicate in an impressive manner the constant and periodical growth of waterworks pumping equipment in a large city. The evolution of modern types of machines is clearly indicated.

THE main, or as it is usually termed, "Low Level" pumping station of the City of Montreal water works department, is probably one of the finest examples in this country, of the gradual modernization of an equipment that, while originally of ample capacity for the purpose for which it was designed, was forced to keep pace with the unprecedentedly rapid growth of our largest city.

The water supply was originally drawn from the St. Lawrence river, at a point 5½ miles above the plant and some distance above the Lachine Rapids, through an open canal which gave a head of about 20 feet at the present location, where a dam and hydraulic development furnished sufficient water-power to pump enough water for the Montreal of the fifties and early sixties.

In 1868 when the limits of the water power had been reached, the first steam installation was made, as an auxiliary to the hydro-power station, and an addition of 10,000,000 gallons to the daily capacity was deemed ample for years to come.

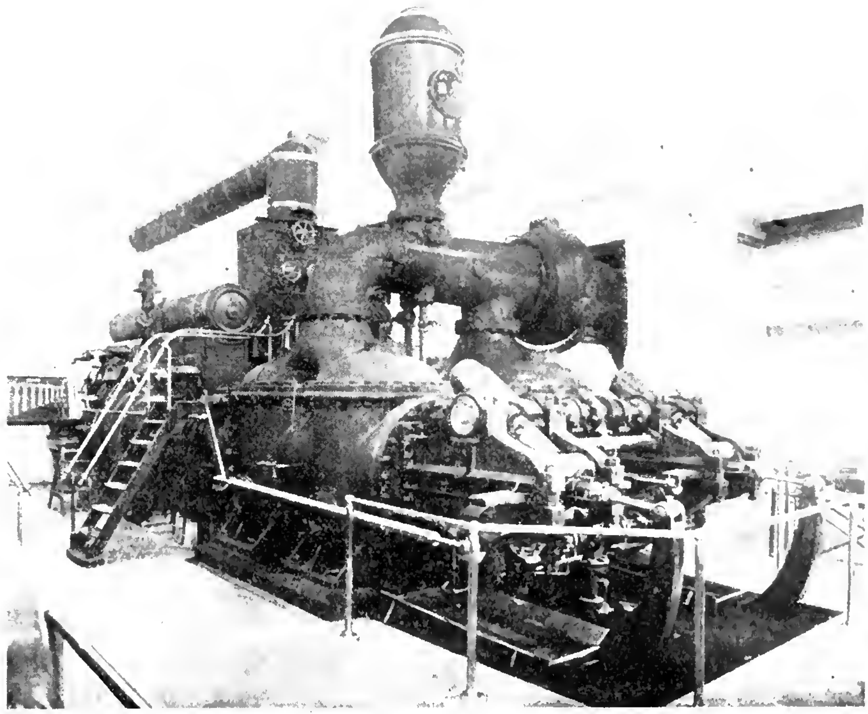


FIG. 2. WORTHINGTON DUPLEX HIGH DUTY STEAM PUMP.

In the eighties began the real growth of Montreal which was so much more rapid than anticipated, that from 1893 the authorities found themselves called upon to furnish water each year to from 20,000 to as many as 45,000 additional new inhabitants; a condition that had been almost impossible to foresee, until at present the municipal service is capable of furnishing a population of 750,000 souls.

FIG. 1. LOW LEVEL PUMPING STATION, MONTREAL CITY WATER WORKS.

Looking at Fig. 1, there will be seen at the extreme right, the end of the old hydraulic plant, which is soon to be demolished to make room for the new projected hydro-electric station, when the old canal had been widened, deepened and concreted. The next building to the left contains the first auxiliary steam units, and the other buildings contain the additional equipment which to-day constitute one of the most complete and economically operated pumping plants on the continent.

Pumping Equipment

The plant from the very nature of its growth exhibits in itself a most interesting history of the development of pumping machinery during the past 50 years.

No. 1 pump, which is not shown in our illustrations is still in active service, and No. 2, which is seen in Fig. 2, is a pump furnished by the Worthington Pump Co. to supply water for general purposes at the Columbian Exhibition

in 1893. This pump with a capacity of 8 million gallons per day was at that time the last word in economy and efficiency, and brought to its builders the Grand Prize in competition with the whole world.

It is most interesting to turn to Fig. 3, a photograph of a De Laval turbine driven centrifugal pump of 30,000,000 gallons capacity, which has just been installed. This unit is driven by a multi-stage De Laval steam turbine which develops 1,800 horse power when running at 3,600 revs. per min. The power from the turbine is transmitted to the pump by double helical gears which revolve the pump at 600 r.p.m. The steam turbine exhausts into a Wheeler condenser, which maintains a vacuum of 29 inches. The condensate is pumped by hot well pump through an auxiliary heater in condenser head to an open type Cochrane heater, which reheats the condensate to a temperature of 210 degrees Fahr., by means of low pressure steam taken from low pressure stage of turbine.

After leaving the heater, the water is passed through a Cochrane type V notch recording meter to the feed pump, which returns water at steam temperature to the boilers. The hot well pump is also driven by steam taken from low pressure stage of turbine.

In the background of Fig. 3 may be seen the "Columbian" pump, and the progress in pump design, during the past 30 years could not be better illustrated.

Fig. 4 illustrates the intermediate stage of pump design, being a "McDougall" centrifugal pump, direct connected to a "Browett-Lindley" high-speed triple-expansion engine, and of this type, there are four pumps in plant.

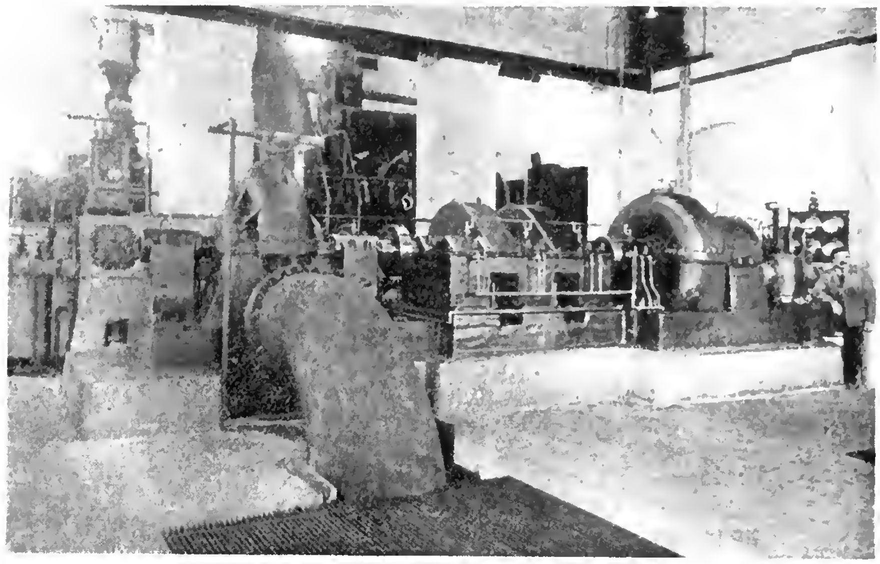


FIG. 3. SINGLE STAGE, 30-IN. DE LAVAL TURBINE PUMP DIRECT CONNECTED TO DE LAVAL MULTI-STAGE, 1800 H.P. IMPULSE STEAM TURBINE.

The total pumping capacity of the present equipment, pumping against a head of 210 feet to the lower level reservoir above McGill University is as follows.

1	Worthington	10	million gals. per 24 hours
2	Worthington (Columbian)	8	" " " " "
3	Jno. McDougall Caledonia Iron Works	12	" " " " "
4	Worthington	12	" " " " "
5	Jno. McDougall	12	" " " " "
6	Canada Foundry	12	" " " " "
7	Jno. McDougall	12	" " " " "
8	De Laval Co.	30	" " " " "
	Total capacity	108	" " " " "

Boilers

The boiler room like the pumping station shows the same evidence of expansion and modernization. The original pumps were designed to operate at 110 pounds steam pressure, and the boilers that served these pumps were operated at this pressure. With the newer pumping machinery came engines requiring higher pressures, and with the exception of six old boilers that are used for the two oldest pumps, steam pressure is carried at 150 pounds, with 100 degrees of superheat.

The principal units in operation are, 6 Heine; 3 Caldwell; 3 Robb-Mumford; 2 Howden; 1 Canada Foundry; 4 Wicks, three of the last mentioned are of vertical type and all the others are horizontal water tube boilers. The most recent equipment consists of the three vertical Wicks, 350 h.p. boilers; and last but not least is the 500 h.p. horizontal Wicks, shown in the foreground of Fig. 5, which is a view of the north side of the boiler house.

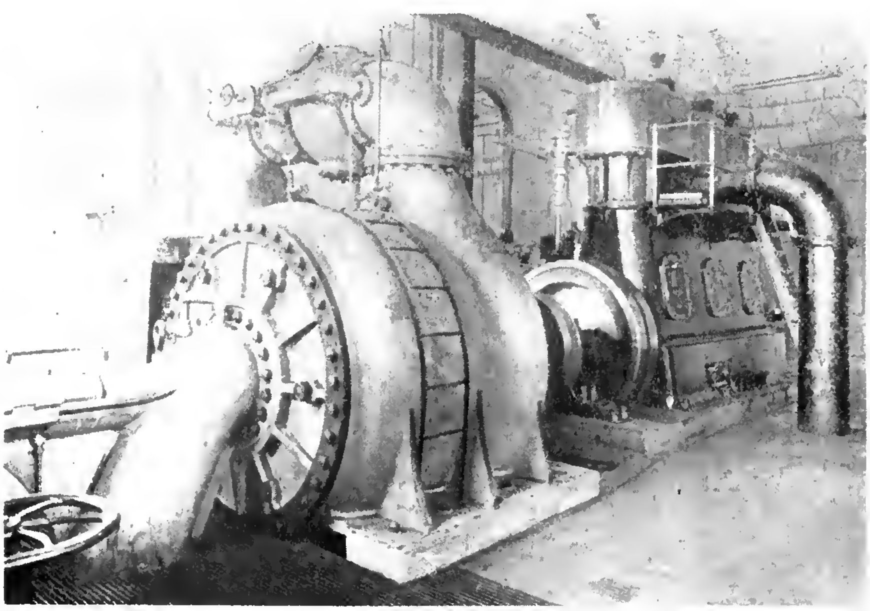


FIG. 4. THREE-STAGE, 20-IN. McDOUGALL TURBINE PUMP DIRECT CONNECTED TO 750 H.P. BROWETT-LINDLEY VERTICAL TRIPLE EXPANSION, QUICK REVOLUTION ENGINE.

Fuel and Combustion

Bituminous coal was the fuel used for many years, but owing to smoke for which the plant was formerly somewhat notorious it was decided to use small anthracite "Bird's Eye" coal mixed with 15 per cent. bituminous slack.

Forced draught is used, with special grates, and the results have entirely justified the change. The estimated saving by using the cheaper grades of coal is about $40,000 annually, and with the exception of a few minutes, when cleaning fires, there is never more smoke than is shown in Fig. 1.

Every car of coal, when delivered at the plant, is sampled, and tested at the water department laboratory by the

chemist in charge with a Per Se mechanical agitator to determine condition as to size and dust, and is also analyzed for efficiency, or the number of British Thermal Units contained per pound of coal.

Each smoke flue is connected by means of ⅛ inch brass tubing to a room behind the boiler house where gas samples can be conveniently drawn from any boiler flue and analyzed. This practice is of great value in determining the state of efficiency at which the plant is being operated.

The forced draught equipment consists of undergrate blowers. Some of the boilers are equipped with steam jet blowers and special grates supplied by the Cotton Furnace Corporation, Newark, N.J.; three units with a similar system installed by J. W. Lamoureux of Montreal, while the last 500 h.p. Wicks' unit is equipped with a Coppus Turbo Blower and special grates supplied by H. L. Peiler & Co. The Coppus blower is seen in the right-hand foreground of Fig. 5.

All the forced draught is automatically controlled by Mason No. 4 damper regulators, operating special cone-seated balanced valves, which give extremely close and accurate regulation and were furnished specially for this service by H. L. Pelier & Co.

Auxiliaries

As all the pumping engines are run condensing, there is very little exhaust steam available for heating the feed water. The only exhaust available for this purpose at atmospheric pressure is from the engine of a high-speed electric light set of 40 horse-power, also from the exhaust of the boiler feed pumps, only one of which is in operation at a time. To overcome this difficulty and utilize any available heat losses, two closed feed water heaters are connected to the exhaust line of Nos. 3 and 4 pumping engines between the engine and the condenser. The exhaust steam is under a vacuum of 28 inches at this point, but the feed water heaters absorb sufficient heat from this exhaust steam to raise the temperature of the feed water to from 90 to 100 degrees F. or practically to within 10 degrees of the temperature of the exhaust steam at the relative vacuum.

The cold water from the mains is pumped through these two heaters to a third smaller unit in which all the available atmospheric exhaust is condensed, yielding a final temperature of from 160 to 190 degrees according to the load. The heaters used in this case are of the Reilly multicoil type, and were supplied by H. L. Peiler & Co.

This is said to be the only case in Canada where exhaust steam at a high vacuum is used for this purpose, and the estimated economy is about $12,000 per annum.

The two feed pumps are of the duplex type made by the Deane Pump Company of Holyoke, and were supplied by the

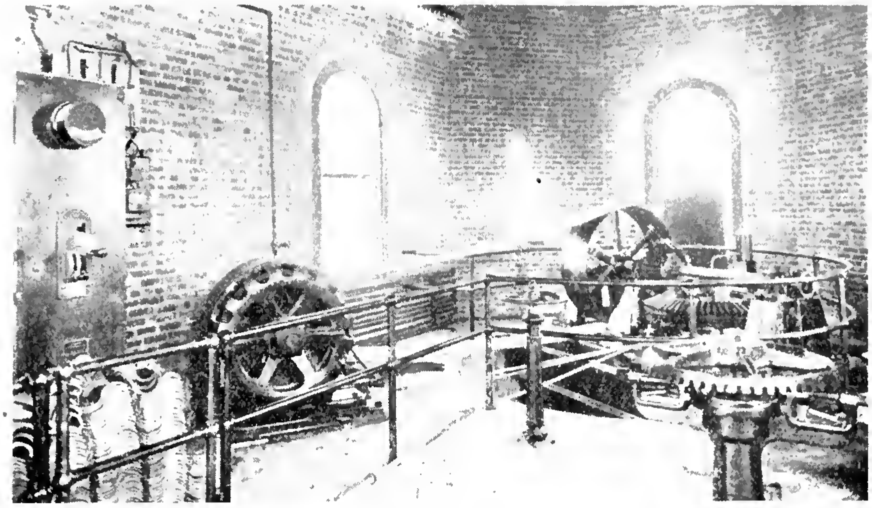


FIG. 6. LOW LIFT McDOUGALL SUBMERGED CENTRIFUGAL PUMP, BELT-DRIVEN FROM A 75 H.P. WESTINGHOUSE INDUCTION MOTOR.

FIG. 5. NORTH SIDE OF BOILER ROOM SHOWING COAL AND ASH HANDLING EQUIPMENT.

John McDougall, Caledonian Ironworks, Montreal, and Ross & Greig, Montreal.

All high pressure drips such as those from the steam separator, the steam mains at each end of the plant and from the steam jackets of the cylinders of Nos. 1, 2 and 4 pumps, are drained by Bundy traps discharging to a closed receiver in the boiler room from which they return automatically and under pressure through a No. 124 Bundy return trap direct to the boilers.

As No. 1 and No. 2 pumps are designed for low pressure, this is reduced from 150 lbs. to 110 lbs. by a Mason standard reducing valve.

The boilers are equipped with automatic feed control of the Berry & Williams type and the feed pumps are controlled by Mason pump pressure regulators.

Emergency Station

In case of any unforeseen accident, whereby the supply from the river should be cut off, an emergency conduit from the Lachine Canal has been installed. The fall from the canal to the plant is sufficient to supply the pumps, but it was deemed advisable to install machinery to raise the water to a height of about 6 feet.

Two similar units with a capacity of 40,000,000 gallons per day have been installed for this purpose. One of these is shown in Fig. 6. These are of the low lift submerged centrifugal type and were installed by Jno. McDougall, Caledonia Iron Works.

About six years ago, the control of the technical branch of the water works department was placed entirely in the hands of the Engineer-Superintendent, and marked changes were made in the whole operation of the plant.

The entire credit of the modernization of the pumping and boiler equipment is due to Mr. T. W. Lesage, the present superintendent, who has been ably supported by Chief Engineer E. F. Valiquet and Second Engineer J. Maconomy. It is a noteworthy case of the complete rehabilitation of a plant that was formerly a by-word for inefficiency, and which to-day ranks as one of the most efficient steam plants on the continent.

To Treat Zinc Ore.—The zinc industry in British Columbia will receive a big impetus in the establishment at the Trail smelter of a large plant for treating zinc ore, to be operated by the Canadian Consolidated Mining and Smelting Co. The plant is expected to be completed by January 1. It will cost in the neighborhood of $1,000,000. The owners are mostly C. P. R. directors.

CANADA'S DEBT INCREASING

THE net debt of the Dominion has now passed the half-billion mark, being at the end of November $501,668,167, an increase of nearly ten millions during the month. This does not include the new Canadian hundred million-dollar War Loan, which will bring the net debt over six-hundred millions. This will be almost double the public debt at the commencement of the war, and will involve an annual interest charge of nearly thirty million dollars.

At the opening of the war, Canada's public debt stood at $331,873,814. The increase, therefore, not counting the new internal loan, has been, since the war began, $169,794,353. Of this, $127,265,431 is attributable to war expenditures, every cent of which has had to be borrowed. This leaves $42,528,922 to be accounted for by other borrowings.

Next Four Months 60 Millions More

War expenditure for the year ending March 31, 1915, was $60,750,476. For the first eight months of the present fiscal year it totalled $66,514,955. For the next four months, owing to the ever-increasing number of Canada's fighting men, and the necessity of providing them with extra winter clothing, another sixty millions will be added. The expenditure for November alone exceeded thirteen million dollars. At the end of the fiscal year, therefore, Canada's total war expenditure will have reached 190 million dollars.

For the fiscal year following, the Minister of Finance estimates that the expenditure will be $250,000,000, or $1,000 per man. Thus, if the war lasts until March 31, 1917, Canada's war expenditure will have totalled 410 millions, bringing the public debt, without taking into account the probable necessity of borrowing for domestic purposes, up to 800 million dollars, or $100 per head of population. The interest charges on this alone will be nearly forty million dollars annually, or three times the interest charge on the public debt before the war, and almost half the proceeds of the customs revenues of the Dominion during normal years.

Must Retrench

An annual expenditure for pensions of at least ten million dollars will bring the additional amount which Canada will have to pay from revenues every year as a result of the war up to at least fifty million dollars. At present Canada's total revenues are inadequate to meet her ordinary and capital expenditure without heavy additional taxation and borrowings. It is clear, therefore, that with an additional inevitable increase in that expenditure of fifty millions, retrenchment in other directions will have to be assiduously practised if the country is to be saved from a further addition to the enormous debt which she will carry, even should she be permitted to withdraw her armies from the field in the time mentioned above.

This year's domestic deficit will be less than it was last year, according to present indications. During the last fiscal year it totaled something over fifty millions. As compared with the first eight months of last year there is an apparent gross betterment during the first eight months of the present year of twenty-seven millions, made up of an increase of fourteen millions in total revenue and a decrease of thirteen millions in expenditure. In connection with the increase in revenues, customs accounts for about 8 millions, post-office receipts for about 3¼ millions and public works, including the State Railways, for about 3½ millions, there being a decrease in excise and miscellaneous receipts.

Merchants Replenishing Stocks

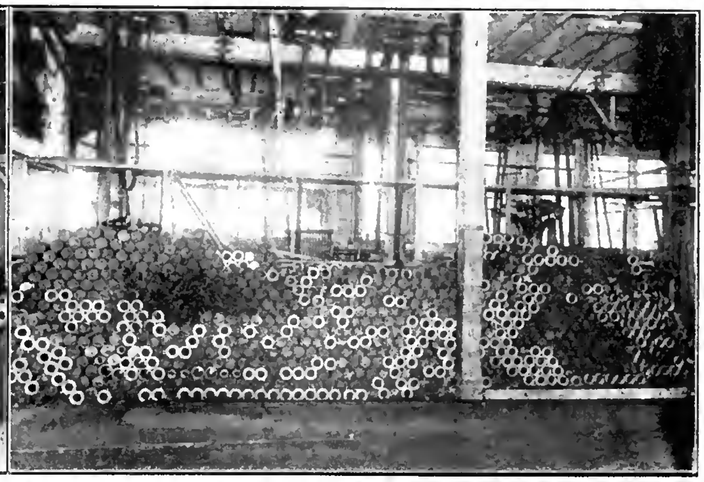
As an indication, for instance, that merchants are now compelled to replenish their depleted stores even in the face of a customs duty, which in October last averaged 36 per cent. on all dutiable goods imported. customs revenue for November increased by five millions over that for last November, or by over 100 per cent. How much of this represents duties collected on raw materials for war orders upon which a drawback will later be accorded when the finished product is exported, is not known.

The Government railways appear to be doing a gratifying amount of business this season, there being an increase in receipts for November as compared with November, 1914, of $1,800,000. The traffic carried this year on the National Transcontinental from Winnipeg to the head of the lakes, operated for the first time by the State, may account for a considerable portion of this increase.

Retrenchment Slight

The decrease in expenditures recorded for the eight months is accounted for by a retrenchment of ten millions in consolidated or ordinary expenditure and of three millions in capital expenditure as compared with the same period of the preceding year.

The turning over of a large part of militia expenditure to war appropriation accounts for six millions of the decrease in ordinary expenditure. Since the total expenditure for 1914-1915 (exclusive of war) amounted to 184 millions, an actual retrenchment of seven millions must be considered insignificant in view of the present world-wide financial situation.



New Machines and Appliances Evolved by Canadian Firms

Selected and Compiled

Not the least gratifying industrial feature of the past year has been the success attending the efforts of many of our shell makers to supply both their own and the needs of others at home and abroad in the matter of special machines and fixtures to accelerate and procure high quality munitions production. Many of these machines possess a permanent value and will therefore remain in service for years to come, practical mementoes of these times.

ALTHOUGH prior to the war most manufacturers were of opinion that machine tool builders had produced all of the various types of machines that were considered economically possible, it remained, in many instances, for firms with no pretensions as machine tool builders to fill not only their own demand but of others also, for tools of diverse requirements. As each requirement of the industry became known, it was quickly and efficiently sized up, so the necessary machines made their appearance, and the list of these which are briefly described below indicate more than anything else, the completeness of the grasp which our metal working plants have acquired of the entire work of projectile manufacture.

Cutting-off Machines

John H. Hall & Sons.—Their cutting-off machines have been redesigned and new models brought out which are adaptable to shrapnel and high-explosive shell work. The bed of the machine is heavily constructed and to it is bolted the headstock. The spindle is of serviceable dimensions and rests in ample bearings, the whole being entirely enclosed by a cast iron cover. The cut-off slide is provided with two tools, working in opposite directions, provided with power feed. Longitudinal travel to the tool slide is obtained by means of a screw and star-wheel conveniently placed at the end of the machine. These machines are driven by a pinion and spur gear, the power being received on wide-faced belt pulley.

Hamilton Gear & Machine Co.—A cutting-off machine designed and built by the Hamilton Gear & Machine Co. consists of a main bed casting upon which is mounted an annular chuck with automatic jaws, which grips the shell body leaving both ends exposed. The shell is placed in the chuck from the back, and is located by a stop rod, positioning from the inside base of the shell. Two tool-slides are provided, one on each side of the chuck, the slide at the back carrying a tool which removes excess metal from the shell base, while the front slide carries a cutting-off tool which trims the shell to correct length. The chuck is driven by means of a spur gear and pinion, the latter being keyed to the drive shaft placed at the back of the machine. A clutch pulley, operated by a hand lever, drives the shaft, ample belt power being provided for the heavy work required of it.

Single-Purpose Lathes

Canadian Fairbanks-Morse Mfg. Co.—Are building a manufacturing lathe of limited capacity(designed to meet the demand for a plain heavy standard lathe, which can be easily handled by non-skilled labor. The steel gearing is cut from the solid, and the headstock bearings are fitted with brass bushings and ring oilers. The lathe is regularly furnished with a solid spindle, having nose bored for No. 5 "Morse" taper centre. The carriage has power longitudinal feed only. Automatic stops control this obtained by means of a shifting lever in the gear box. The feed is positively driven by gears from the spindle, all gears suitably covered. The tool box is of the European type, of ample proportions, and has hand cross-feed only. Two speeds only are furnished by the 6-in. wide cone steps, which are of 11 and 14 inches diameter respectively. The bed is 7 feet long, very rigid, and allows 21 inches between centres. A maximum swing of 16 inches diameter is available over the bed, and 10 inches over the carriage. When desired, this lathe can be furnished with various attachments for different operations.

John T. Hepburn.—A plain lathe designed to insure speed and accuracy with unskilled labor. The bed is of rigid construction, with flat ways. The spindle is driven through a single belt pulley 13½ in. dia. x 8 in. face, with friction cone clutch. The carriage is simple in design and carries a solid tool box slotted to receive the tools. The carriage has power traverse, and is also provided with a double lever for moving by hand.

Heavy Duty Duplex Lathe

Canadian Linderman Co.—Two heavy hollow spindles triple geared on the nose avoiding torsion strains. No. 5 socket and face plate for chuck or special tools: two milling machine type carriages on heavy dovetail ways, provided with cross-slide or other special equipment for profiling, reaming, boring, drilling, facing, recessing, etc. This tool was brought out for 3.3, 4.5, and 6 in. high explosive shells by the Linderman Machine Co. for their United States and Canadian shops where they have forty-five in operation doing practically all operations on high explosive shells, except waving and threading milling, and as sixty per cent. of the operations require only one man to handle two shells, this machine has already fully demonstrated its ability as a cost reduction machine.

Expanding Chuck

R. McDougall Co.—An excellent type of expanding chuck is made with a hand-wheel fitted to a rod which extends through the hollow lathe spindle. Two sets of three jaws expand and tighten against the shell, which is pushed on the chuck until the end of the lathe, which acts as a stop, is in contact with the bottom of the shell. The jaws are caused to expand by two tapered lengths of the central spindle of the chuck. A stiff spiral spring, which acts as a means of adjustment, is placed between the two tapered portions. Thus as the small pair of jaws are designed to seize just before the larger, this spring allows the tapered portion of the spindle to continue to tighten the larger jaws. Flat steel springs withdraw the jaws from the work when the hand-wheel is turned.

Waving and Undercutting Attachment

John Bertram & Sons Co.—A fixture which may be attached to any style of lathe has been designed and built by the John Bertram & Sons Co. The shell is held in the chuck, to the face of which is attached a triple-face cam. The tool holders are bolted to the ways of the lathe, the front holder supporting the waving tools and the rear holder the left and right-hand undercutting tools Fastened to the lathe saddle are the two cam brackets. At the beginning of the operation the saddle is moved towards the headstock and causes the cam on the brackets to force in gradually both the front and back tool holders. The front holder is held up against the cam on the chuck by means of a spring. The cam imparts an oscillating motion and gives a wave to the ribs. At the same time the undercutting tools which slide in diagonal guides are forced in by two cams on the rear bracket, giving the desired angle to the undercut. A stop in the centre of the fixture regulates the depth of cut for all the tools.

Nosing Presses

Brown-Boggs Co.—A standard geared straight side press has been adapted for nosing light shrapnel shells. The shell is placed on the bed plate of the press, a support being provided to hold the shells in the correct position. A heavy nosing die is attached to the end of the ram; suitable ways or slides being provided in the sides of the press in which the die slides. This machine is also equipped with a four-point instantaneous clutch. Apart from being designed for the economical production of shells, it will also give good results as a general purpose press.

Canadian Locomotive Co.—The banding press made by this company can be equipped for the nosing of shells. All that is necessary to change the press over into a nosing press is to insert a steel plug in the centre of the machine. This plug is provided with a shank, which extends down and rests on top of the piston, from whence it gets its motion. A fixture is mounted on the centre of the machine, into which the nosing die is fixed. The shell is placed on the plug and is moved upward, the nose coming in contact with the die, which forms it to the desired shape.

Thread Milling Machine

Holden-Morgan Co.—A machine designed for the purpose of milling the thread in the base and nose of high explosive shells is proving very efficient, since it eliminates the risk of having the threads stripped. A casing, containing a hollow revolving spindle is supported on the left side of the machine bed. The inside end of the spindle is cone-shaped to take the nose, the spindle being self-centering. Power is supplied to the spindle through a worm driven by means of a pulley direct driven from shafting overhead. The outside centre of the spindle is threaded and a clamp provided to close over the thread when the spindle is required to travel horizontally. The milling cutter is held in a head which has no lateral motion. The shell is placed in the spindle from the left-hand side and secured. The milling cutter is inserted in the nose as far as the recess, and the cross-slide moved up to a graduated stop, which gives the required depth of thread. The spindle containing the shell is then made to revolve slowly, and at the same time travel horizontally outward or away from the cutter. The spindle makes one revolution, at the end of which an automatic stop is thrown out. The threads are now cut and the shell removed.

Banding Presses

Canadian Fairbanks-Morse Mfg. Co.—A powerful hydraulic press for pressing the copper bands on shells is manufactured by this concern. The frame ring is heavily constructed, being made of steel and supported on a substantial base. The six pressure cylinders and plungers are of an ample size, the diameter of the cylinders being 9 inches. The shell is placed in the centre of the press, and the plungers with the attached die-blocks are brought up to the copper band, squeezing it into place under a pressure of 750 lbs. per square inch. Oil, which is used to transmit the pressure, is supplied by a high-pressure power pump. The entire control is by means of a small hand valve; a safety valve also being provided to prevent accidents.

Canadian Locomotive Co.—The pneumatic press which this firm has placed on the market is different in many respects from other apparatus mentioned. The press consists of a heavy bed plate, supported on three suitable legs, and beneath which is placed a large air cylinder. Slides are provided for the jaws, the faces of which are slightly corrugated horizontally. A toggle motion transmitted to the jaws from the pneumatic piston causes them to converge as the piston ascends, while gravity causes the piston to descend as soon as the air is released. This is done automatically by relief valve. The diameter of the piston on this press is 28 in., and the air pressure used is 100 lbs.

Chapman Double Ball Bearing Co.—A feature of the Chapman hydraulic banding press is that it may be used in any other capacity since the machine is a standard "Perrin," four-post vertical press. The banding attachment is supported on suitable legs secured to the lower or vertical table. The device consists of a circular plate with a hole of suitable size in the centre, to accommodate the shell. Eight segmental jaws are arranged to slide in suitable grooves on the upper side of the plate, their outer ends forming part of a cone, while the inner ends are curved to fit around the copper band. Suspended from the upper table of the press, is a hollow casting containing a hardened steel ring with a conical bore, into which the attachment is forced by the upward movement of the lower table. This action causes the segments to converge on the band and press it home in the groove. A total pressure of 50 tons on the ram is ample power for 18 pdr. shells.

Jenckes Machine Co.—In connection with the manufacture of shrapnel and howitzer shells a banding press has been designed and put on the market by this firm for the purpose of pressing the copper band into place in the grooved recess on the shell body. The machine consists of a base or stand which is a heavy substantial grey iron casting, with a raised portion on which a ring rotates. This raised portion is slotted for six steel plungers, which are machined to bear on wedge-shaped recesses in the ring. The inner dies which actually press the copper band are machined as one piece, and afterwards cut in six sections, these being loosely pinned to the plungers to keep them in their relative positions. The plungers are all returned after the movement of the ring by means of the springs shown. The main lever and the toggle lever are steel castings.

The whole arrangement is operated by means of a 12-in. air hoist cylinder, controlled by a four-way valve, which permits quick and positive action. The air hoist cylinder is riveted to the main base

in such a way that the cylinder carries the motion of the lever without any tendency to cram.

Lymburner, Ltd.—A hydraulic press designed to operate at a maximum pressure of 1,500 lbs. per square inch, has been put on the market by this firm. The press is heavily constructed throughout, being supported on a solid cylindrical base. The circular frame which is of cast steel, encloses six cylinders on the inner ends of which are hardened steel die-blocks or segments. Oil, supplied by a pressure pump, is used for operating the press. This oil passes through 3/8 in. pipes, and enters a space between the stationary pistons and the movable cylinders. As the pressure rises it is transmitted through the cylinder and die blocks to the copper band. Coil springs are provided which force the cylinders back after the pressure has been released.

Band Turning

Jenckes Machine Tool Co.—The bed of the lathe, is a heavily ribbed flat top casting supported on legs of a standard type. The spindle is a substantial hollow steel casting, finished all over, and is driven through a 22 in. by 8 in. clutch pulley. The clutch is of hard maple, cone type, and is operated by a compresed air piston, controlled by a valve. The chuck is also operated by compressed air and is of the draw-in type. The tool slide base is heavy and immovably clamped to the lathe bed. The front or roughing tool is fed in by a screw and hand wheel to a dead stop, leaving a light cut for the finishing tool. The latter is mounted to the rear and above the work, being so adjusted that it can pass down behind the shell and in passing shave the band to size. The feed is by lever operating a pinion an d rack. The tools on this machine can be removed for regrinding and be replaced with precision.

Lymburner, Ltd. — The Lymburner band turning attachment which produces excellent results in finishing copper bands, consists of a rigidly constructed frame, which is secured to the ways of the lathe in use, in the required position. A single point roughing tool is fed by means of a hand wheel, in a direction parallel to the shell. At the same time as this tool is roughing the band, a slide holding the forming tool is advancing towards the work, being fed by means of the same hand lever and spindle as the roughing tool. When the roughing is finished, the forming tool enters and shapes the band. An upright slide, at the back of the device holds the finishing tool, which is forced down by means of a rack and pinion operated by a hand lever. This tool shaves the copper band to the correct size.

Mechanical Plug Wrench

Holden-Morgan Co.—A machine of entirely new design, for screwing home the plugs in the base of shells has been developed by the Holden-Morgan Co. The bed of the machine is a hollow iron casting supporting two spindle bearings and a table for the vise. A large spur gear is keyed to the end of the spindle and is driven by a pinion on a clutch shaft placed at the side of the bed. The chuck on the spindle is made to take the square end of the base plug. The plug is entered in the base recess, and the shell then placed in the vise with the square end of the plug in the chuck. A foot lever draws the spindle and chuck back at the same time forcing the shell towards the chuck. The clutch at the side is then thrown in, the spindle revolves, screwing the plug into the shell base. A spring forces the spindle towards the shell, following up as the plug enters. When the plug is driven home, the tension is thrown back to the clutch which slips. The friction device on the clutch is adjustable and can be set to any desired tension. The machine as a whole is of simple design and construction, and contains very few parts that can get out of order.

Shell Marking Machines

Brown-Boggs Co.—The mechanical device employed in marking the base of shells, in the machine here described varies somewhat in principle from the majority of marking machine being so arranged that the pressure is exerted on each individual letter and figure successively. The bed of the machine is similar in form to that of a lathe, on one end of which is supported a driving spindle with the revolving pressure chuck. On the opposite end of the machine is the saddle with a clamping device for holding the shell. The operation is very simple. First, the marking collar, in the base of which are inserted the desired letters, is placed over the end of the shell and secured by a thumbscrew. The shell is then clamped in the saddle, and is moved up to the pressure chuck by means of a handwheel. As the chuck revolves two inserted rollers in the face force each successive letter and figure into the base, the depth of the impression being increased or decreased as desired by moving the work carriage to or from the pressure chuck.

Shell Marking Machines

Holden-Morgan Co.—A compact and accurate machine for marking shells consists of a main base casting with two heavy uprights and a cross-piece, between which the shell is supported on rollers. A marking wheel with inserted letters and figures is held in a hollow bracket placed between the two uprights; one end of the bracket being pivoted. In operation the shell is placed on the rollers, and the bracket with the inserted marking wheel is forced down by means of a screw which is threaded through a central boss on the cross-piece. An oscillating or rocking movement is imparted to the marking wheel by means of a pinion and gear with the necessary crank attachments. As the marking wheel is forced on to the shell it also causes the shell to roll backward and forward on the rollers till the necessary impressions are made. When the shell is marked the screw is released and the bracket forced away from the work by means of a heavy spring. Power is supplied to the pinion by means of a belt and pulley.

Painting Machines

Canadian Fairbanks-Morse Mfg. Co.—The following painting machine consists of an upright standard secured to the base by stays and which carries the revolving table and operating mechanism. The table contains six sockets driven by means of a motor secured to the base casting. The belt from the motor is carried over two guide pulleys to a horizontal wheel. Attached to this wheel is a sprocket wheel connected by chain drive to a similar wheel on one of the spindles of the rotating sockets. On this spindle is a smaller sprocket, connected by an endless chain to a similar wheel on each of the other spindles. By this arrangement all the spindles revolve at the same speed, i.e., about 250 r.p.m. The shells are now placed in the sockets, nose down and revolve independent of the table. Stands for the paint cans are provided, so that two men can work at one time. The machine is portable, and so can be taken to the work without difficulty.

Canadian Locomotive Co.—An interesting type of painting machine is made in the shape of a huge drum, on the top of which is mounted a circular table resting on five rollers, three of which are made of laminated leather and impart a revolving motion to the table. Mounted around the outer edge of the table of the machine are sixty hinged bolts. The brass sockets, which are screwed into the shell nose, are then slipped over the bolts, nose down. A bracket to carry the paint can is slipped over the central stationary spindle of the machine, and can be moved around to any desired position. The operator swings the shell inward, upon the hinged bolts. This causes the bevelled surface of the brass casting in the shell nose to come in contact with the large central revolving disc. The shell is thus rotated and the paint applied with the greatest ease. Steam coils are placed in the centre of the machine, which permits the shells to be dried very quickly.

Marine Terminal of the G.T.P. Rly. at Prince Rupert, B.C.

Staff Article

The construction and installation of a floating drydock, together with a shipbuilding and ship repairing plant at the Western Terminal of the Grand Trunk Pacific Railroad, constitute an engineering achievement of no mean magnitude. Aside, however, from the latter feature, the establishment of such a combination plant is indicative of the far-seeing policy pursued and developed by the railroad management relative to its Pacific Coast shipping.

THE primary consideration in the development of this drydock undertaking was the isolated geographical position of the town of Prince Rupert from the nearest supply base, some 600 miles.

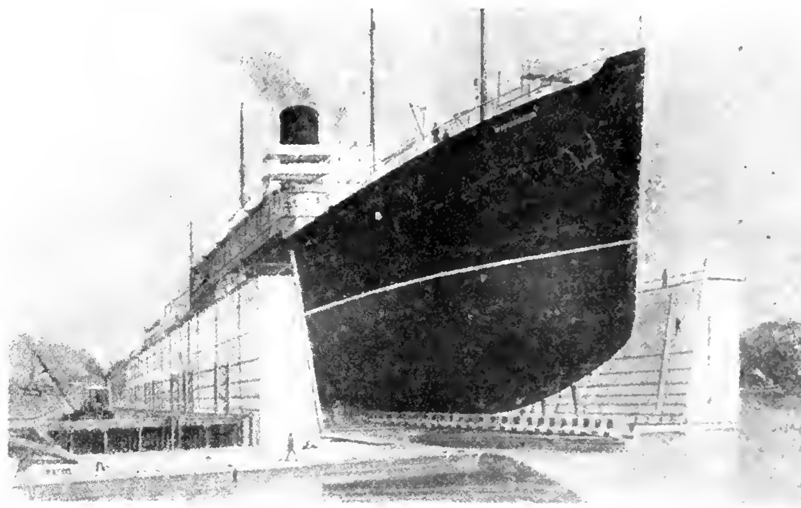
To facilitate the erection of the complete plant, the structures first built were utilized in constructing the remaining buildings and docks. The first work to be completed was the pier and launching platform, followed by the erection of the power house and the installation of the necessary equipment. After the completion of the engineering and administration buildings, the final work of constructing the 20,000-ton pontoon floating dry dock was successfully accomplished, and the operating machinery erected in position.

A general view of the shipbuilding plant and dry dock, and the latter with a large vessel aboard are shown on this page, and serve to indicate the plant capacity.

The opening of the new dock is an event of much importance, not only to the town of Prince Rupert, but to the many shipping interests in British Columbia and adjoining territory.

Floating Dry Dock

The entire dry dock, with a total lifting capacity of 20,000 tons, is composed of three distinct and separate, but interchangeable units. The centre unit of six pontoons, with an overall length of 269 feet, is capable of raising and supporting a vessel of 10,000 tons; while each end section, of three pontoons, and a length of 164 feet, will carry a weight of 5,000 tons. These pontoons are united by steel side walls or wings, 38 feet high, 15 feet wide at the bottom and 10 feet wide at the top.



THE NEW FLOATING DRYDOCK WITH A LARGE VESSEL ABOARD.

The structure as a whole is secured to the pier by the engagement of clamps on the dock with a vertical truss, secured to the pile platform in such a way that it is free to rise and fall with the tide (which in the spring is often 25 feet), and when being raised or lowered with a vessel aboard.

When it is desired to use the dock in separate sections, the forward three pontoons can be detached and moved around the corner of the pier and located alongside the platform. To use the remaining portion as two separate docks, the middle section of six pontoons is detached from the rear section and moved forward the length of the front section, and secured in position. The sliding clamps are so arranged that whether the

VIEW OF G.T.P. MARINE TERMINAL, PRINCE RUPERT, B.C., SHOWING HARBOR, FLOATING DRYDOCK AND WORKSHOPS.

dock is used as separate units or complete, the attachments on the pier will coincide with those on the floating dock.

Each pontoon is of timber construction, 130 feet by 44 feet by 15 feet deep, with a crown of 3 inches at the centre, and having 15 trusses spaced on 3-foot centres. A water-tight bulkhead, 12 inches thick, runs below the keel blocks of each section, and partial bulkheads on each side are used to strengthen the structure. The entire dock is made water-tight by caulking with white pine wedges, and protected from toredo and other marine worms by a coating of tar and gravel, poisoned with arsenic. Over this are two layers of hair felt, similarly treated, and covered with creosoted lumber secured with galvanized nails.

Pumping Machinery

The operation of lowering and elevating the dock is accomplished by twenty-four 12-inch centrifugal pumps, one in each end of each pontoon. The pumps on each side of the three sections are connected by a vertical shaft and gearing with a horizontal shaft to a motor placed on the top of the pontoon wall. Two 200 h.p. motors are used on the centre section, and the pumps on the end sections are operated by four 100 h.p. motors, one on the wall of each section.

The motors are alternating current, 3-phase, 25-cycle, 550-volt, with wound rotors and slip rings for variable speed control. The armature operates at about 500 revolutions per minute, and drives the pumps through reducing gearing at 275 r.p.m.

Workshops and Their Equipment

All buildings are of steel frame construction, with roof and floors of reinforced concrete; the walls of the power plant are also of reinforced concrete, those of the other buildings being, in addition, covered with wood. The entire equipment is of the most modern type, and machinery installed is capable of handling the heaviest and largest repairs that may be required upon any vessel operating on the Pacific Coast.

In laying out the general plan for the present site, the possibility of future shipbuilding developments was carefully considered, and, while the construction of steel vessels will not materialize for some time to come, it was nevertheless deemed advisable to construct buildings of a permanent nature.

The broadside system of launching has been provided for.

Pier Derrick

An interesting feature in connection with this terminal is the pier derrick shown here. This crane has a hoisting capacity of 50 tons, and is capable of taking care of the removal or installation of the heaviest pieces of machinery from or to the hold of vessels in Northern Pacific waters. It is also used for the unloading of material from vessels lying at the dock to cars upon the pier. Drydock and plant features are given in brief as follows:—

Type of dock—Floating.

Built by Grand Trunk Pacific Railway Co.

Location—Prince Rupert, B.C.

Estimated cost—$2,500,000.

Capacity of dock—Two sections of 5,000 tons each, 1 section of 10,000 tons; total, 20,000 tons.

Drydock Dimensions

Overall length on dock keel, 604 ft.

50-TON PIER DERRICK.

Clear width, 100 ft. between walls.

Width overall, 130 ft.

Number of lifting pontoons, 12 only.

Length of each, 130 ft.

Width of each, 44 ft.

Depth of each, 15 ft.

Buildings

Iron and brass foundry, 75 x 150 ft.

Machine shop, 75 x 150 ft.

Boiler and blacksmith shop, 75 x 150 ft.

Shipbuilding shed, 160 x 300 ft.

Power house, 104 x 148 ft.

Side launch platform, 440 x 80 ft.

Chimney on power house, 175 ft. high, 11 ft. diam.

General

Quantity of lumber in 12 pontoons, 4,000,000 ft.

Quantity of galvanized fastenings in pontoons, 400 tns.

Weight of each pontoon, 490 tns.

Lifting capacity of each pontoon, 1,700 tns.

Quantity of bolts and spikes, 360 tns.

Quantity of steel in wings of dock, 2,400 tns.

Number of rivets used in dock, 500,000.

Number of 12-in. centrifugal pumps, 24.

Capacity of each per minute, 5,000 gallons.

Time required for pumping entire dock, 1½ hours.

Quantity of paint used on wings, 13,000 gals.

Quantity of fireproof roofing used, 130,000 sq. ft.

Quantity of lumber in wharf, 3,000,000 ft.

Quantity of piling in wharf, 268,000 lin. ft.

Quantity of filling, 303,000 yards.

Area of yard, 20 acres.

Length of ship that can be docked, exclusive of overhang at bow or stern, 600 ft.

Width of ship which can be docked, 95 ft.

Maximum draft of ship that can be docked, 30 ft.

The power house contains two 1,000 k.w. turbo-generators and a large air compressor. A system of underground electrical conduits has been installed throughout the shipyard, as well as compressed air lines. The boiler room equipment will consist of six 400 horse-power water tube boilers, having automatic chain grate type stokers, such as are known to give satisfaction with Pacific Coast coal.

The ship-shed is provided with two 10-ton travelling cranes, and vessels can be constructed in this building under cover. The engineers who designed the dock and were in charge of construction are Messrs. Frank E. Kirby and Wm. T. Donnelly, of New York, J. H. Hillsbury, of Prince Rupert, acting as their local representative on the work. Chas. H. Crowell is general manager and superintendent of the dry dock.

LAKE FREIGHTERS SOLD FOR OCEAN SERVICE

TWO lake freighters of the type very much in demand have changed ownership. Both are steel vessels, which have been in the Great Lakes trade for several years. They are the steamers G. R. Crowe, of the St. Lawrence & Chicago Navigation Co., and the Algonquin, of

the Port Colborne & St. Lawrence Steamship Co.

The steamer Crowe, which has been sold to an English syndicate, will be converted into an oil tank steamer for Atlantic coastwise and Gulf of Mexico service. The work of remodelling the Crowe will be done at Midland, where she will winter. The sale price of the Crowe was not divulged. Lake ships are in great demand just now for the overseas trade, and it is announced that the Crowe brought a good profit to her late owners.

The G. R. Crowe was built in Dundee, Scotland, eight years ago for the St. Lawrence & Chicago Navigation Co., and is a steel steamer, 331 feet long, with a 43-foot beam, and a moulded depth of 26 feet.

The Algonquin is well known in Toronto harbor, and was one of the first steel steamers to be brought to Canada. She was built by R. Napier & Sons, Glasgow, Scotland, in 1888, for Thomas Marks & Co., of Port Arthur. The Algonquin, which latterly has been sailing under the flag of the Port Colborne & St. Lawrence Steamship Co., has been purchased by A. B. Mackay, of Hamilton, who recently negotiated the sale of the steamer Turret Chief to a British syndicate.

It is understood that the Algonquin will be remodelled for overseas service during the winter. She is a sister ship to the Rosedale, and has plied with uninterrupted success on the Great Lakes since her arrival from across the ocean.

LACHINE CANAL 1915 SEASON

FINAL figures regarding the Lachine Canal navigation season of 1915, show that 41,352,876 bushels of grain were brought down as against 67,343,952 bushels in 1914, a decrease of 25,991,076 bushels. Of all the grains, only corn showed an increase, the 702,736 bushels brought down this season being 592,803 bushels more than in 1914. Wheat showed the greatest decrease, the 30,443,678 bushels received being 19,445,565 bushels under last year's total. The other figures for this year, with the decrease in each case, are as follows: Oats, 8,499,035 bushels, decrease 3,690,542; barley, 1,276,810 bushels, decrease 2,937,673; rye, 23,135 bushels, decrease 250,087, and flaxseed, 407,482 bushels, decrease 260,012.

The total number of vessels which used the canal were 590, as against 615 last year, a decrease of 25; but their combined net tonnage this year amounted to 249,050, an increase of 19,795 tons. The total number of trips was 7,820, which was 1,229 trips less than in 1914. As a result, the total combined tonnage for these 7,820 trips only amounted to 4,110,579, or 879,393 tons less than in 1914. The total tonnage of grain and miscellaneous cargoes carried was 964,916 tons under the 1914 figures, the total for this year being 3,265,294. There were 63,294 passengers carried through the canal and down the rapids, as against 90,989 in 1914.

The statistics for the year also show the following balances of advantage for 1914: Let passes issued last year, 5,764, this year, 4,820; lockmasters' tickets up, 1,334 and 1,018; lockmasters' tickets down, 3,014 and 2,560; permits to pleasure craft, 312 and 187; coal, 1,138,738 and 1,070,138 tons, a decrease of 68,600 tons to harbor, canal basin and up the canal; trips made light for return cargoes, 3,418 in 1914 and 2,942 in 1915, a decrease of 476. Deducting the number of trips made light from the total number of trips made, the result shows that only on 4,878 occasions did vessels carry cargoes, as against 5,631 times in 1914.

Building Materials Carried

In building materials, lumber brought down from Ottawa for United States ports unexpectedly showed a considerable increase, 19,107,600 feet board measure, or 46,214 tons having come down this year. Also there were 41 rafts of 5,000 lineal feet each, making a total of 205,000 lineal feet, or 4,100 tons, which passed through to the harbor during the season. There were 48,297 tons of sand up from the harbor to the canal basin, a decrease of 17,416 tons, and 44,866 tons down, a decrease of 23,778. This makes a total decrease of sand carried as compared with 1914 of 41,194 tons.

There was an increase of 1,019 cords of pulpwood up to Canadian ports, the total amount being 23,759 cords; and a decrease of 5,459 cords to American ports, that total for the season being 137,951 cords. This makes a total decrease of 4,440 cords. No pulp went to Canadian ports at all this year, as compared with 1,600 tons in 1914; also 26,137 tons went to American ports this year as compared with 36,012 tons last year, making a total decrease of 11,475 tons.

The comparative figures for "up or westbound" traffic and "down or eastbound" traffic are as follows:—Number of trips, up, 3,864; down, 3,956; tonnage of vessels reported, up, 2,008,474; down, 2,102,105 net tons; cargo tonnage, up, 799,203; down, 2,466,091 net tons; number of passengers carried, up, 15,846; down, 47,448.

Seagoing Tonnage

The following figures indicate that though there was a falling off in the total tonnage passing through the canal, the American tonnage increased:—Canadian steamships, 178 in 1915, and 190 in 1914; American steamships, 46 of 52,651 net tons, as compared with 27 steamships of 26,270 net tons in 1914, Canadian barges, scows, etc., 215 in 1915, and 255 in 1914; American barges, 6, as against 9 in 1914; American canal boats, 145 of 14,683 net tons in 1915, and 134 of 13,206 net tons in 1914. Of the Canadian steamships reported, some 50 vessels with a tonnage of 58,702 operated in coastal and overseas trade during the season. Of the American steam vessels reported, 18 vessels, having a total net tonnage of 25,241, passed out for American ports in consequence of the law forbidding railways to own steamships.

Because of the million sacks of flour in the gift to the Imperial Government from the Dominion in 1914, this year's total for flour passing through the canal is 123,273 sacks, being 1,040,985 sacks under last year. The comparative figures for 1914 and 1915 respectively for produce carried through the canal are as follows: Eggs 14,909, and 14,465 cases, a decrease of 444; butter, 6,544, and 4,984 packages, a decrease of 1,560; cheese, 194,834, and 221,212 boxes, an increase of 26,378; apples, 30,448, and 25,131 barrels, a decrease of 5,317.

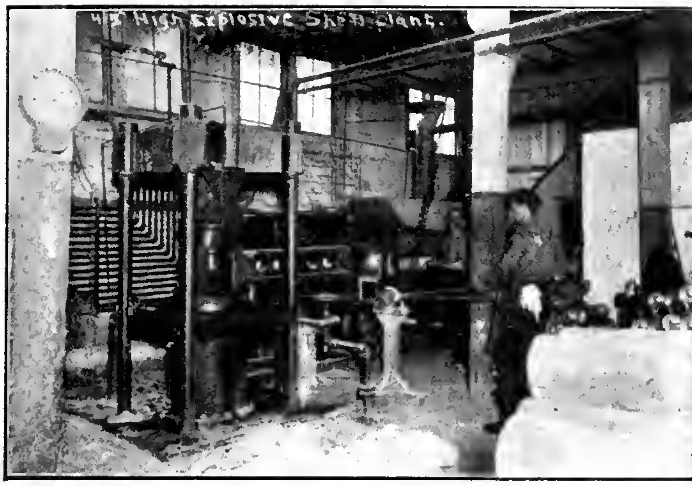
The first vessel down in the spring was the W. H. Dwyer, which was entered on the canal books on April 23, with 73,636 bushels of wheat, and the last boat through the canal was the Wylie M. Egan, with coal.

G. T. P. STEAMSHIPS

ACCORDING to information received at Grand Trunk Pacific headquarters in Montreal, the G. T. P. steamships operating in the North Pacific Coast waters have covered over eighty thousand miles during the season of 1915. This is considered one of the most remarkable records in the coastwise trade.

Running between Prince Rupert and Seattle the steamship "Prince Rupert," between June 8 and November 4, steamed 40,717 miles, almost twice the distance round the world. Her sister ship the "Prince George," covered 40,840 miles. The average distance run per day by these vessels was 395.86 miles, and the average speed per hour 16.49 knots. In order to keep their schedules, these steamships often steamed over 18 knots, reeling off better than 400 miles in a day. The steamships were timed to arrive at Seattle at 6.30 a.m. and 4 p.m., respectively—equal to any railway schedule.

Travel between North Pacific coast points remains fairly good and service is to be maintained between the Transcontinental trains of the company at Prince Rupert and the cities of Victoria, Vancouver and Seattle throughout the winter.



Typical Tools and Devices from Canadian Shell Shops

Selected and Compiled

The advent of shell making was signalized by a country-wide activity in designing and constructing the necessary tooling outfits for adapting existing plants to the new work. Great variety of thought has been evidenced in the production of special fixtures and operating devices, the all around excellence of which has contributed greatly to the success of our efforts.

IN visiting and describing the many plants engaged in projectile manufacture, numerous appliances are observed which, while of most immediate value to their present users, have more than a passing interest to machinists in general. A number of these are outlined herein and form a creditable record of initiative and resource.

Cutting Off Billets

Montreal Locomotive Co.—Planers were at one time used to cut the bars into billet lengths, but this method has now been discontinued. A very much similar arrangement is, however, employed on two large "Niles-Bement-Pond" millers. Clamping devices rigidly secured to the table hold 32 bars at one setting and eight large Disston cold saws cut off the billets. The travels of the table is completed in about two hourse, and when it has gone about half way, men at the rear remove the billets and set up another set of bars in their place, so that when the table has completed its travel the cutting arbor is raised and the table returned to commence cutting at the other end. The later cut billets are then removed and are replaced by bars, the cutting-off process being thereby almost continuous.

Facing Off Bases

John Bertram & Sons Co.—After the ragged open ends of the forgings are cut off, the bases are next squared up. This may be accomplished in a vertical boring mill by the use of a special fixture. The fixture is made of cast iron, being cylindrical in shape, with a heavy flange on the bottom, by which it is bolted to the table. On the outside of the cylinder is a series of lugs between which the forgings are clamped. In order to insure uniform thickness of the bases, the forgings are placed over, and rest upon studs of standard height, which are placed in the flange centrally between the lugs. The tool is fixed, being previously set to a gauge block. This fixture is capable of holding twenty forgings.

Canadian Fairbanks-Morse Mfg. Co.—A large 4-spindle "Ingersoll" milling machine is utilized to its full capacity, for machining the shell bases. The shells are held in fixtures, placed at each end of the table. These hold 28 shells in four groups of seven shells each, and are so arranged that the cutter heads come into action on their own group of shells simultaneously; the vertical heads projecting in advance of the side heads. The operation is practically continuous since while one group of shells is being machined the operator is employed at the opposite end emptying and reloading the other fixture.

C.P.R. Angus Shops.—The back ends of the forging may also be milled off on a vertical milling machine. A fixture, which accommodates these forgings is secured to the table. The forgings are pushed into the fixture, open ends first, until they come against a stop, and are then clamped securely by set screws. The table is moved into a stop, and then traversed by power, causing a solid milling cutter, 2½ in. in diameter, to pass over the face of the shell. It requires about two minutes to complete one base and the operation is practically continuous, as finished shells can be removed, and rough ones put in place while the machine is running.

Canadian Locomotive Co.—A "Newton" rod miller equipped with two special fixtures extending the entire length of the table is found to give continuous service for the work. After the ragged ends are cut off, the shells are placed in the fixtures; one clamp or strap, the inside of which is formed to fit the outside diameter of the shell, serving to hold two shells. Two cutters are used, each being eight inches in diameter, by 10 inches face, and having inserted teeth. As the finished shells pass under the head they are removed and rough blanks placed in the fixtures, while the machine is still in operation. When the table arrives at the end of its travel, the heads are slightly raised, and the table quickly run back to commence another cutting stroke.

Montreal Locomotive Co.—In facing off the bases of 4.5 shells a planer fitted up in the following manner is being used to advantage. A heavy forging having a series of V's or notches cut in it, is clamped to the planer bed. The shells are placed in the V's, three shells to each, and are gauged for length by having the shell noses "butt" against a bar fastened to the inside edge of the forging. They are then securely clamped by a heavy bar extending along the top. In machining the bases the side-head with vertical feed is used.

Centering Jigs

Canadian Ingersoll Rand Co.—For turning in the Lo-swing lathe with a mandrel, a centre must be formed on the back end of the shells, and this is done in a little drill press. A jig having an upright arbor, over which the shell is

placed, is secured to the drill table, and a hinged strap is placed over the top of the jig. A small drill, 5-32 inches in diameter, is run through the pilot hole, care being taken not to have this hole too deep because the back end of the shell when finished must have no marks on it. For this reason the drill is equipped with a stop. The hinged strap is then swung open and the shell and jig are shifted over under the second spindle of the drill press. A tool which forms the centre is carried in this second spindle.

Toronto Structural Steel Works.—An interesting design of centering jig which is rather simple in construction is giving excellent service. It consists of an upright arbor fastened to a block which slides in vees formed on the table of the drill press. A bushing, shaped to conform to the rough bore of the forging, near the base, slides on the arbor and is maintained in position near the top by means of a spring; the spring resting upon a shoulder formed by the lower part of the arbor. There is also provided another bushing, which is made a sliding fit for the lower part of the arbor, and is also held in its highest position by means of spring. This bushing is made with a suitable taper so as to rest half way into the open end of the forging. When the rough forging is placed over the arbor, it centres itself on the two bushings, which compresses the springs till the weight of the forging is taken by two stop pins. When the arbor is in its outer position in the vees, ample room is provided, clear of the spindle for placing and removing the shells. Centering is done by a combination drill and centre

Drill Jig for Shrapnel Noses

Alfred Herbert, Ltd.—A jig used in conjunction with a ball bearing drill press for drilling and tapping the small holes in the noses of the larger shrapnel shells, consists of a casting bored to receive a sleeve in which the shell is clamped. At the right hand end a small bracket and locating plug locate the nose. The jig is semi-automatic in its action. When the operator pulls a handle towards him the locking bolt is withdrawn, and on pushing it back the sleeve carrying the shell rotates until the bolt drops in again. This jig is exceedingly rapid in action and the whole arrangement very compact.

Expanding Mandrels

Canadian Ingersoll Rand Co.—An interesting type of mandrel used on an engine lathe, is one which is operated by air. A hollow arbor has a tapered shank to fit the lathe spindle, which is also supported and keyed to a casting fitted to the spindle nose. A plug screwed into the end of the arbor acts as a locating stop. Two sets of jaws are operated by means of a hollow sleeve and shaft similar to that used on the mandrel previously described. These sets of jaws are operated by a small air cylinder placed on the end of the lathe. When the air is turned on the piston is forced back in conjunction with the shaft and sleeve. The tapered portions on the end of these engage with the tapered jaws forcing them out against the wall of the shell. A retaining spring of suitable strength holds the jaws together and causes them to fall away from the work upon the return of the piston to its original position.

Canadian Locomotive Co.—The distinctive feature about the following type of arbor is its simplicity in design. The body, which is made of steel is turned to three diameters, being bored at the larger end to fit the lathe spindle, and counter bored, tapered and threaded to fit the rod which operates the jaws. The second diameter is turned so that the forging will slip over easily. To the smaller diameter is fitted a milled jaw which acts as a stop and locator. Three slots are milled near the inner end of the second diameter, and corresponding jaws made to fit. These jaws are operated as previously stated by means of a central rod which passes through the lathe spindle. When this is screwed in by means of a handwheel keyed to the outer end the tapered portion forces out the expanding jaws. When the rod is withdrawn a spring fitted to grooves turned in the thin jaws, causes the jaws to contract, leaving the forging free to be removed.

Chapman Double Ball Bearing Co.—In rough turning the shell body a specially designed mandrel for this class of work gives excellent service. The hollow arbor has three shoes at the front and three at the back which grip the forging at the base and nose respectively. A hollow sleeve, tapered on one end to engage with the rear set of shoes extends the full length of the hollow spindle of the headstock. A shaft which is mounted in the sleeve and tapered on the end to engage with the front set of shoes, extends throughout the length of the hollow sleeve, projecting past the end of the sleeve. The sleeve and shaft have left and right hand threads respectively cut on these outer ends, each with a handwheel threaded to suit, by means of which the shoes are tightened or released. A chuck, fitted to the lathe spindle, has a floating ring which is tightened on the nose of the shell and drives same.

Jenckes Machine Co.—When a boring mill is used for rough turning the outside diameters of shells a specially constructed arbor is required. One used on a "Bullard" mill is made with a heavy base by which it is bolted, centrally to the table. The body of the arbor is bored, and a small pilot or rod, tapered on the end to engage with a set of shoes, is made to fit. The shell is placed over the arbor and by means of an eccentric, placed at right angles to the pilot, the latter is forced up, causing the shoes to expand and grip the inside base of the shell. The nose of the shell is gripped by means of chucking arrangement similar to that used on a universal chuck, the jaws gripping the shell from the inside.

J. A. Moffat.—An expanding mandrel used in turning shells where the bore is parallel, is made as follows: A sleeve is turned to about .010 in. smaller than the bore of the shell, and a tapered hole, threaded at the smaller end is bored along its entire length to fit a tapered plug. The sleeve is split in the centre, thus allowing it to expand when the plug is screwed in. A round steel spring holds the two pieces of the sleeve together. The outer end of the plug is centred and has a square milled on it which fits a driver on the face plate. The threaded end is made, a standard pitch thread, which prevents the plug from pulling out when the sleeve expands.

Lymburner, Ltd.—Another type of mandrel has a flange which is secured to the face plate or chuck. A sliding collar or sleeve slips over the outside of the casting, and when this sleeve is advanced by means of a lever, three internal tapered slots act upon corresponding dogs. This action forces a hardened steel bushing forward and pulls the central rod backward. Tapered grooves formed on the bushing and end of the rod, force steel dogs, arranged in groups of three, outward, causing them to grip the shell. In releasing the shell, the sliding collar is moved back, and a spring acting on the bush and steel collar causes a relative movement between the bush and shaft, thus allowing the dogs to release their hold.

E. T. Spidy.—Since long holes are not always perfectly straight, a mandrel to average up the hole has been designed. It consists of a body threaded to suit the machine spindle, and bored out parallel. A spindle is fitted closely to this bore, which has a cotter fitted at the lathe spindle end. Corresponding slots are milled in the body to allow for the travel of the cotter. On the outside of the body two steel sleeves are fitted, then split in three sections, these being held together by a retaining spring. A solid sleeve placed between these, acts as a spacing block and transmits power applied by the centre spindle, through a nut and end bushing. By this method all the tapered faces act in unison, but

do not tighten up till both split sleeves are engaged with the hole.

Nose Bevelling Cutter

Toronto Structural Steel Works. — A tool for shaping the mouth of 4.5 shells preparatory to nosing was designed to be used in connection with a radial drill. It consists of a sturdy bar, a suitable tapered shank being turned on one end to fit the drill spindle. The other end is provided with a substantial pilot turned to fit easily in the bore of the shell. This allows the full power of the machine to be applied without causing excessive chatter. A slot is milled in the body of the bar to suit the cutter, which is of the flat double-edged type, bevelled to the correct angle. This is securely held by means of a tapered key. This key is left sufficiently long to project beyond the cutter, thus enabling it to act as a suitable stop.

Combination Reamer

Canadian Buffalo Forge.—A reamer for finishing the inside body, reaming the counterbore and roughing the fuse plug seat is used in a 20-in. drill press. The reamer is about 13⅞ in. long over all and has a taper shank for fitting into the drill press spindle. At the end of the shank the reamer widens out, and has slots for four fly cutters. These cutters are ⅜ in. square and have a bevelled cutting face for forming the fuse plug seat. The cutters are held securely in position by a ring with a set-screw for each. Under the set of cutters is a reamer for finishing the counterbore in the nose preparatory to being threaded. At the other end of the spindle, the exact distance away, is another reaming cutter for finishing the bore of the shell. The cutters are secured to the spindle by dowel pins. In operation, the bottom cutter starts at the top of the hole, and travels down with power feed, followed by the cutter above. When both have nearly finished their work, the four small cutters above begin the form of the fuse plug seat. This combination makes a very accurate and efficient tool.

Grooving, Undercutting and Waving

John Bertram & Sons Co.—Cutting the groove and wave is done on an ordinary engine lathe fitted up with a special fixture. One end of the shell forging is held in a chuck which has a cam attached to its face, while the other end is supported in a cup centre. The tool holders are secured to the lathe bed and the brackets, holding the feed cams to the saddle. The grooving and waving tool is held in the front holder, and the undercutting tools, left and right hand are held in the back holder. In operation the saddles move forward and cause the cam on the brackets to force in gradually both front and back tool holders. The front holder is held up against the cam ring on the chuck by means of a spring. As the cam revolves with the chuck it imparts a reciprocating motion to the tool which thus forms waves on the ribs. At the same time the back tool holders are forced in to undercut the sides, by the two cams, in a diagonal direction, obtained by the holders running on diagonal guides. A stop regulates the depth of all tools.

Canadian Locomotive Co.—These operations are performed on a C. M. C. lathe in the following manner: A tool post fitted to the back of the cross-slide holds a roughing tool which when fed in cuts the groove, roughing to width. This is withdrawn and a turret tool holder mounted on the front of the slide is brought into operation. The right and left hand undercutting tools, which operate in slides of the correct angle, are fed in by means of a cam shaft to the end of which is attached a hand lever. The cam is so designed that the tools cut to the finished depth and width just as the highest point of the cam is reached. The tools are now withdrawn and the turret swung around permitting a roller to register against a three-point face cam, attached to the face plate. By pressure of the roller against the cam plate, the necessary oscillating movement is communicated to the waving tool, which when fed into the finished depth, cleans up the bottom of the groove, and at the same time cuts the wave ribs.

Lachine Mfg. Co.—A device for undercutting the sides of the driving-band groove consists of a flat plate provided with two grooves machined to the proper angle, and in which slide two tool carriers. These have a number of rack teeth cut on their adjacent sides to engage with a pinion which when oscillated by a suitable lever, brings either tool in operation as desired. The tool carriers are made a close sliding fit in the grooves and are retained in position by suitable keeper plates fastened to the main castings. Adjusting stops are also provided at the outer end of each carrier to regulate the depth of cut.

A. B. See Elevator Co.—A special fixture used on a McDougall lathe shows a considerable amount of ingenuity in design. The main casting which comprises a roller steady rest and tool posts is bolted to the lathe carriage. The shell is driven from the nose end by means of a chuck, and is supported near the base by the steady rest, leaving sufficient room for the operation of the tools. The first operation after setting up is grooving, the tools for this purpose being held in the front tool post. A combination tool post at the back holds the knurling and undercutting tools. When the knurl is in position the undercutting is performed by two tools which are operated in slides planed to the correct angle.

Toronto Structural Steel Works.—An ordinary engine lathe equipped with a well designed combination turret tool box and the familiar cam ring on the chuck gives good service for these operations. The shell base is supported in a cup center and is driven by a plug centre in the nose end. The grooving tool is of novel design, being formed in two parts and is fed in to the required depth and moved to each side to form the desired undercut. A relieved portion in front of the tool allows for a sufficient amount of material to be formed into the waved ribs. A toggle arangement is secured to the end of the tailstock, by means of which a bar is caused to compress two springs which force the carriage against the cam ring on the chuck, thus imparting the desired reciprocating motion to the tool. A roller on the side of the carriage makes contact with the cam.

Thread Milling Attachment

Marsh and Henthorn—The converting of a universal grinder into a thread milling machine, demonstrates what may be done in the way of adapting standard machines to special work. All that is necessary is to mount a special head on the work spindle embodying a large bearing, which when bored and split makes a combination chuck and bearing. The necessary travel is given to the head by means of a fourteen pitch master screw, working in a nut of the same pitch. The arbor which carries the milling cutter is supported in the wheel stand.

Grinding Shell Bodies

Hamilton Gear & Machine Co.—The special holding arangement designed for use on a Ford-Smith grinder differs somewhat from that in other shops. The shell is mounted on centres, and is driven by gripping the nose end of the rough shell about where the shoulder is to be finished. This method of driving relieves the chuck of all strain due to the pressure of the grinding wheel. The live centre offers a firm support for the shell and conveys the grinding vibration directly into the frame of the machine. The reduction of noise due to this method is remarkable.

A. B. See Elevator Co.—The external grinding of shells is being accomplished by means of an old lathe fitted up with a taper attachment. A suitable casting is secured to the cross-slide, carrying the arbor and grinding wheel which is belt-driven from an overhead shaft. Brackets are fastened to the back of the lathe to

which is bolted a plate, with a cam attached, and shaped to suit the contour of the nose. A roller is held in contact with the cam by means of a spring on the cross-feed spindle.

J. H. Moore.—To make sure that all shell bases are of uniform size and finish there has been designed and built the machine herein described. It is what might be termed a special purpose grinder, being built for this work only. The work chuck is of the three-jaw universal type, allowing the shell to be quickly and accurately adjusted in position. The shell is gripped around the body just above the driving band, leaving the base end exposed. The grinding wheel is mounted between driving flanges on a spindle carried by a grinder head, which is arranged to slide crosswise on the carriage. This machine grinds two surfaces, as in addition to facing the base end of the shell, the wheel is used to grind the outside diameter of the base, thus necessitating a longitudinal motion by means of hand wheel and rack on the front of the machine.

Profiling Attachments

Canadian Fairbanks-Morse Mfg. Co.—After nosing, the shell is rough turned to profile with a flat forming tool. Following this it is chucked by the base, nose down, in a universal chuck secured to a drill press spindle. It is then forced down into a fixture which has three pairs of guiding rollers and also a flat forming tool for finish scraping the nose to shape. One pair of rollers is fastened on a gate, which opens to allow the shell to enter and leave the fixture. The action of this method is identically that of a huge pencil sharpener.

Hamilton Gear & Machine Co.—The profiling attachment here used varies somewhat from the usual arrangement. The templet is mounted on a rigid bar, which is securely fastened to the tailstock instead of the headstock, as in some cases, or the lathe bed in others. The adoption of this principle overcomes the necessity for locating the shell accurately in the chuck in relation to the templet, and also enables full advantage to be taken of the allowable variation in the overall length of the shell, so that when a shell comes through which is a little long, it is not necessary to remove any more metal than is necessary to come below the high limit; whereas when the profile copy is fixed rigidly to headstock or lathe bed, the tool will cut to the same point every time, unless the shell be adjusted in the chuck, which takes time, and is not so easily controlled as the method described.

Toronto Structural Steel Works.—An interesting attachment for use in profiling may be described as follows: A supporting bar is fixed to two blocks which are clamped over the front vees of the lathe bed at suitable points. A roller is mounted in a bracket fastened to the side of the cross-slide. By means of two powerful springs attached to the lathe carriage, the cross-slide is pulled forward keeping the roller in contact with the profile bar which is mounted on the supporting bar.

Drill Press.—A method of using the drill press for profiling is in connection with a hollow mill with inserted cutter. The cast iron body is provided with a taper shank to fit the drill spindle, and is bored out concentric with the shank, to the finished shape of the shell. The outside diameter is made considerably eccentric, the heavy side being cut away to allow the blade to be secured in the proper position. It is held in place by a clamping plate, which is formed with a heel, thus providing suitable support for the adjusting screws. This tool is used only for the finishing cut or scrape.

Driving Device

Toronto Structural Steel Works.—A driving device used in connection with a profiling attachment previously described, combines a driving plate and a method of locating each shell in relation to the profile copy. A cast iron arbor which is threaded to fit the lathe spindle is turned to a suitable diameter to receive an indexing plate, holding a spring plunger. The nose of the arbor has a left hand thread 2.6 in. diameter, which fits the driving plate; a spot being recessed on the back of this to receive the plunger. The point of the arbor is turned down and a hardened steel cap, threaded to fit the shell nose is provided. The shell is screwed on to the end of the arbor till it tightens against the edge of the driving plate, the left hand thread automatically locking the parts together. After the shell is machined, the plunger is removed from the driving plate, which is then slackened off by means of a wrench. When the shell is screwed off the arbor the driving plate is turned back to its original position, and locked by the plunger.

Copper Band Turning

John Bertram & Sons Co.—A simple method of machining the driving band is by means of two tool holders secured to the front and back of the cross-slide. A bracket is secured to the side of each tool box, which holds an adjustable set screw, which acts as a stop. The roughing tool is held in the back holder, and is fed in by hand by means of the cross feed handle, till the stop is reached. The feed handle is then reversed, causing the roughing tool to back out and the finishing tool held in the front holder to enter and complete the cut.

Canadian Ingersoll Rand Co.—Engine lathes equipped with suitable fixtures are extensively used in turning the copper bands. The shell is held in a chuck and located by a stop on the cross-slide. The roughing tool is held in an ordinary tool post and fed in to a stop, which determines the depth of the roughing cut. The finishing tool is held in a special fixture secured to the back of the cross-slide. The tool works in a vertical slide on the back of which is a rack. A pinion, operated by a hand lever, engages with the rack thus allowing the tool to be moved down across the back of the shell, shaving the band to size.

Socket Tightening

Chapman Double Ball Bearing Co. —After the shells are filled they are ready for receiving the sockets, and for this purpose a specially designed ball-bearing driver and a large single-ended tap wrench is used. The plug, or driver, consists of a squared shank, and a straight, threaded portion, of the same diameter and pitch as the inside threaded part of the sockets. Upon the upper part of the thread are two steel nuts fitted with grooves on their adjacent sides to form a ball-bearing raceway. The bottom nut seats against the socket, and is jammed by the upper nut on account of the much greater friction in the thread bearing than in the ball bearing. For the same reason the backing of the wrench instantly releases the plug from the socket from which it can be then unscrewed by hand.

Massey Harris Co.—The use of a drill press instead of a hand wrench for driving home the brass socket in the nose of shrapnel shells effects a double saving in the fact that a workman can maintain a higher rate of output; and secondly, the tool employed can be used to reduce the amount of work necessary on subsequent operations. In this case the shell is held in a hinged vise bolted to the table of an ordinary vertical drill press. A hollow mill is fitted to the spindle and when fed down on top of the socket, inserted teeth dig into the metal and take hold firmly. Continued pressure on the feed lever screws the socket home, the point of tightening being indicated by the teeth beginning to cut the edge of the socket. The cutter teeth are so designed that they do the work of a roughing tool, for machining the outside edge of the socket.

Socket Removing

Brown Boggs Co.—It is often necessary to remove the fuse socket, after the final weight test, in order to insert shot and bring the shell up to the desired weight. To remove the socket after it is finished requires careful handling, but the difficulty has been overcome by the

use of the following tool. It consists of a plug threaded right hand to fit the fuse socket. The shank of this plug is threaded left-handed and a nut made to fit. To remove the shell, the plug is first screwed into the socket and then the left handed nut screwed down until it comes in contact with the nose of the socket. Continued pressure causes the socket, plug and nut to unscrew as a unit.

Painting Devices

Vickers, Ltd.—In the painting of shells an ordinary air motor is being used for revolving the jig. Four plates are placed on top of cylindrical pieces secured to the top of the bench. These plates have a stem or shaft passing down through the bench. Attached to the bottom of each shaft is a gear which meshes with intermediate gears. To the central gear is attached the air motor shaft which is supported in an upright position. The shells are placed on top of the revolving plates and are driven by means of a square lug engaging with the square hole in the shell plug.

General.—The following device is giving good results in several shops, although the output is not as large as with multiple painting machines. A cast iron base is secured to the bench and has a ball groove machined on top. A hole is drilled through the centre of the base, and a shaft which is made to fit, is fastened into a head. A ball groove of the same dimensions as that in the base is machined on the bottom of the head, and a cup-shaped recess, with a square boss projecting upwards, is formed on top. Balls of suitable size are placed in the ball-race. The shell is placed in the head, nose down so that the square boss engages with the hole in the plug. The device is revolved by means of a grooved pulley placed on the shaft, beneath the bench, and driven from any convenient source of power.

Pump Drive

Canadian Westinghouse Co.—A simple and effective method of producing a continuous flow of cutting compound used in turning shell forgings includes the use of the back gear hub. The lathe spindle is direct driven by the belt at a constant speed, leaving the remaining steps of the cone unused, and the back gears idle. One of the cone steps not in use is cross belted to the back gear hub from which another belt drives a small centrifugal pump located at the bottom of the machine. By this method the supply of compound can be varied by belting from a larger or smaller step of the cone.

Special Chucks

Brown-Boggs Co. — The following chuck was designed to be used in connection with a Jones & Lamson lathe for rough turning nose and boring operations. The body of the chuck is flanged and bolted to the face plate. Fitted to the tapered bore of the body are three collet jaws, which are held together by means of two coil springs. A rod extends through the lathe spindle and to its inner end is attached a grooved casting which engages with a square lug on each of the three jaws. The outer end of the rod is threaded and carries a hand wheel. By this arrangement the jaws are drawn in, the tapered faces causing them to compress, and securely hold the inserted shell.

C. P. R. Angus Shops. — A simple chuck used in boring operations on shrapnel shells consists of a casting fitted to the lathe spindle. This casting is bored out to receive the shell after which it is split to a suitable distance back. Two studs are screwed into one-half of the casting and nuts on the other end of the studs cause the two sections of the split casting to close in, firmly gripping the shell.

Canadian Locomotive Co.—An excellent type of split collet chuck, for use in connection with a boring mill, is constructed with a heavy flange by which it is bolted to the table. The upright portion of the casting is bored to a sufficient depth, this bore being tapered at the mouth for a considerable distance back. A split sleeve, which is bored to suit the shell forgings, is turned to correspond with the tapered hole in the main casting. The bottom end of the sleeve is turned down, and threaded to suit a heavy nut, and passes down through the base. A recess is provided in the base of the casting in which this nut operates. When the nut is tightened against the top of the recess, it acts similarly to a jack-screw, the tendency being to pull down the sleeve, causing it to contract by the action of the two tapered faces.

C. P. R. Angus Shops.—For holding shells while grooving and waving, the following simple chuck is being used, and is giving satisfaction. The body is fitted to the spindle nose, and is bored out to fit a tapered split sleeve which holds the shell. The outside diameter of the chuck body is threaded at the end and a large nut fitted to it; the latter being recessed and threaded for slightly less than its entire length and the remainder bored to permit the shell to be slipped through. The shoulder which is thus left in the nuts bears against the outside face of the sleeve, and continued pressure on the nut forces the sleeve in, causing it to contract on the shell body.

General.—The chuck here described is one which has been designed for use in finishing the brass sockets. Fitted to the lathe spindle nose is a cylindrical casting, bored to a suitable size and depth, the mouth of which is tapered for a considerable distance back. A tapered split sleeve which is bored slightly larger than the shell is made to fit the bore in the casting or chuck body. The sleeve is compressed, when it is forced in, by means of a geared nut fitted to a threaded recess in the wall of the body, and which engages with a slot cut on the outside of the jaws. The nut is turned by means of a key and pinion, the teeth of which mesh with the teeth cut on the outside of the nut.

TORONTO WORKS DEPARTMENT EXPENDITURE

THE annual report of Toronto Works Commissioner indicates that municipal expenditure in public works has shared in the wave of retrenchment due to the necessity for economy in all non-productive investments. A decrease of \$1,342,757 is shown in the expenditure of the department up to December 4 over that of last year. The principal item of reduction is in the sewer section, the decrease being \$1,239,830.

The main sewage disposal works are now handling an increased flow, exceeding last year's flow by 4,000,000 gallons per day. New sewers to the extent of 32.4 miles were laid.

Roadways, including pavements and sidewalks show a decrease of \$801,039, leaving this year's figure of \$2,736,963 as the largest sectional expenditure. The mileage of pavement laid amounts to 32.867, against 42.93 last year.

The largest item of increase shown is that of \$591,233 in the railways and bridges section. About 25 per cent. of the steel required for the Don and Rosedale sections of Bloor Street viaduct has been fabricated, and 54,000 cubic yards of fill have been deposited in the Bloor Street section. Various other works, including two subways and two bridges, were completed.

The civic railway continues to show a steady increase, the St. Clair and eastern divisions amounting to 16 per cent. over 1914.

The contract for the filtration plant is completed to the extent of 70 per cent., and is expected to be in operation about June 1st.

The installation of two new steam pumping units of 24,000,000 gallons' capacity each has been completed, and now await connection with the distribution system, and contracts have been placed for two electrically-driven centrifugal pumps of 20,000,000 gallons' capacity each. The water consumption to November 30th, 1915, was 16,166 million gallons, compared with 16,818 million gallons for the corresponding period of 1914.

The Origin of Shell Sizes: Their Variety and Purpose

By C. T. D.

The superiority of Germany's ammunition supply was made doubly valuable by the uniformity of her artillery equipment. The overlapping of gun sizes in the Allied forces made the provision of numerous sizes of shells necessary, thus aggravating the problem of quantity supply. The elimination of odd-size artillery will proceed as rapidly as consistent with present operations, the adoption of standard sizes being a question still very much in the future.

WITH each increase of size in the projectiles made by the numerous firms in this country, there has been corresponding interest in the guns in which they will be used. The variety of sizes or calibres called for has not been so great as in other countries, but the comparatively small difference in size, for instance 4.5 in. and 4.7 in., has frequently given rise to inquiry as to the why and wherefore.

With the preparations for large shells going on actively in our midst, interest naturally centres on them more than on shrapnel, especially as the use of the latter seems to be postponed till such time as the enemy can be gotten out of his burrows.

Classification of Shells

For comparative purposes, shells are conveniently classified as heavy, medium and light, and a list of the more familiar British sizes with such particulars as are available is given.

The 9.2 in. shell is the largest so far in course of production by Canadian makers. This size of gun was adopted by England after a number of 9 in. guns had been supplied to Italy by Armstrong of Genoa. The size (9.2) was decided on owing to the adoption of 9.45 in., or 240 mm. as a general standard in most countries outside of England, Russia, Japan, and United States. Projectiles for this gun weigh 375 to 474 lbs., and firing charges 103 to 129, the Krupp standard being 419 lbs. for the shell, and 113 to 173 lbs. for the charge.

The 9.2 in. shells will continue to be in demand by Britain, although the disadvantages of non-interchangeability with the French 9.4 in. ammunition are bound to be felt on frequent occasions at present.

Numerous Shrapnel Sizes

A point which has been noticed by anyone taking even a casual interest in munitions is the number of sizes around 3 in. The sizes in use by the various nations include the French 75 mm. (2.95 in), the English and American 3 in. gun, equal to 76.2 mm., also a German gun of 77 mm.: the size most in use at the present moment being the 85 mm. (3.31 in.), which is in use by both French and German armies, and which is represented in the British sizes by the familiar 3.29 in.

The close approximation of these sizes has lead to the adoption of 3.3 in. as the standard shrapnel size, excepting the French 75 mm. (2.95 in), which possesses individual features of sufficient merit to insure its continued existence as a standard size by itself. As a matter of fact, the excellent qualities of this gun as a field piece, particularly its flat trajectory, render its adoption for short range trench work difficult; consequently in order to get full use of the enormous quantities of ammunition which are being made for this gun, the Creusot people are producing trench mortars which fire the shell at a high angle with a greatly reduced charge, thus enabling shells to be dropped into a nearby trench.

While 3.3 in. has also been in demand as a size for high explosives, there seems to be a probability that this class of shell will be produced more prolifically in the larger sizes of the light shells, and the smaller sizes of the medium shells.

The most important of the remaining sizes in the light group is the 4.7 in. which appeared as the French and German 120 mm. (4.72 in), and has become a standard size with all the leading powers. This size has been developed for naval and field work, and must not be confused with the 4.5 in. which seems to be used chiefly for howitzer work.

Popularity of 6 In. Gun

The 6 in. gun in British and American practice has its equivalent in the 150 mm. (5.9 in.) French and German size.

Shells of this calibre are perhaps more attractive than any other size from the producers point of view. In regard to design they are the largest member of the open mouth, closed base type, of which the 3.3 in. high explosive was the earliest prototype. The nature of machining operations, tooling equipment, etc. is very similar to the smaller sizes, also their features of being easily produced with unskilled labor. Shops, therefore, which were originally equipped for this size should be sure of a continuance of demand over some of the other sizes which are due to be discarded either during or after the war, and therefore will be supplied with ammunition on much more restricted lines than guns of a more permanent type.

The 8 in. and 9.2 in. which are the largest shells contracted for in this country are for use with howitzers on comparatively short range work, and should not be confused with naval or armor-piercing shells of similar sizes.

The 12 in. gun superseded the 10 in. so quickly and completely in British naval practice that Germany and Austria were at a disadvantage with their 280 mm. (11.02 in.) size commonly referred to as 11 in. These were developed by the Krupp people and copied by the Skodawerke establishment in Austria. They were of little use against the straight 12 in. gun, which for many years remained the standard maximum calibre for ships of the pre-dreadnought class.

	Light				Medium				Heavy		
Diameter in inches	3	3.29	4	4.5	4.7	6	8	9.2	12	14	15
Weight of shell, lbs.	.	....	29 to 35	3.5	43 to 62	90 to 115	200	290	772 to 981		about 1700
Weight of charge, lbs.	.	....	..	....	13 to 22	24 to 35			213 to 357		456 to 694

A Famous Gun

The 15 in. calibre is the most famous of large naval guns, and while present developments may see it further advanced in size, the splendid work done by this gun will insure it a safe place in the records of naval warfare.

The maximum size of artillery actually used in the war so far is understood to be the 420 mm. (16.5 in.) howitzer by Krupps, and the 405 mm. (16. in.) howitzer by Skodd. Very little has been allowed to become known regarding these howitzers or their projectiles, although investigations show that two copper driving bands, and a forward land or contact band of the same material are employed.

Fixed and Loose Ammunition

Ordnance of 3 in. bore and under is generally chambered to receive ammunition in which the propellant or driving charge is contained in a brass cartridge

case the exact quantity of the charge being fixed, hence the term "fixed ammunition."

Guns from 3 in. to 6 in. bore may be similarly constructed or may be designed for the use of loose charges in bags or cases, the amount of charge being proportioned to the desired angle and range of fire under various circumstances. Guns larger than 6 in. are nearly always fired with loose ammunition.

Quick-firing guns of 6, 3, and 1 pdr. sizes are in use by most nations, and receive their ammunition from various national arsenals. They are largely used in trench work and submarine attacks, and have been mounted on aircraft. Anti-aircraft guns have been developed in great numbers by all of the powers, but considerable reticence has been shown regarding their details.

Just what sizes of guns will survive can not be foretold in view of probable developments, but the ultimate elimination of many sizes which overlap or possess no justifying advantage, is certain. The present struggle has shown the vital importance, not only of having ample supplies for all guns, but the inestimable advantage of the fewest possible sizes, and these the most adaptable to varying conditions of the conflict. The question of interchangeability between different nations depends on factors which cannot be considered from a technical point alone, and will be determined largely by the political aspect of the world's affairs after the war.

LOCOMOTIVES FOR RUSSIAN GOVERNMENT

THE Canadian Locomotive Co., Kingston, Ont., are building fifty Decapod type locomotives for the Russian Imperial Railways, and the first lot of these has already been shipped. These engines are of interest, not only because of their design, which is a combination of Russian and American practice, but because of their being the first locomotives exported from Canada.

5-Ft. Gauge Track

The locomotives are designed for operation on a 5-ft. gauge track, which is generally used as the standard gauge by Russian railways. The axle loads are limited to 35,000 lbs. per axle, yet the engines are of considerable capacity, having a tractive effort of 51,500 lbs. at 85 per cent. boiler pressure. They are designed to haul 1,000 metric tons up a grade of .8 per cent. at a speed of about 10 miles per hour.

Special materials and equipment have been used to a great extent, and the construction is in accordance with the best American practice, many of the details being interchangeable with locomotives of the same type and size already built by the Baldwin and the American Locomotive Companies.

Fuel and Firebox

The fuel in service is a low grade of soft coal and is burned on a rocking four-section grate with two dump bars. The firebox is of the wide type, extending out and over the driving wheels, and is equipped with a security brick arch supported on water tubes. The boiler is of the straight type with a mud ring made up with cast steel ends and forged steel sides welded together. An auxiliary safety valve dome is provided which carries two safety valves and the whistle; this auxiliary dome is also used for inspection purposes. A third safety valve is attached to the cover of the main steam dome.

The firebox is of copper, as also are the staybolts in the water-legs. The front end of the firebox is supported by three rows of expansion stays; the nut on the upper end of the radial stays is seated in a die forged stirrup which is screwed into the roof-sheet. The locomotives are equipped with Schmidt superheater and outside steam pipes; superheaters have twenty-eight elements with a superheater surface of 563 sq. ft.

Forty-nine of these engines are equipped with the "Rushton" power screw reverse gear, while the "Casey-Cavin" screw reverse gear is to be applied to the remaining one, both gears being operated by air.

The machinery, frames and cylinders are designed after American practice. The pistons are of solid rolled steel with three cast iron packing rings sprung in, and are supported by an extension on the piston rod with a guide attached to the front cylinder head. The cylinder heads are of cast steel, single bar guides of I section being used. The main driving wheels have plain tires, while all the others are flanged, and the wheel base is such that the engine will traverse a curve of 350-ft. radius.

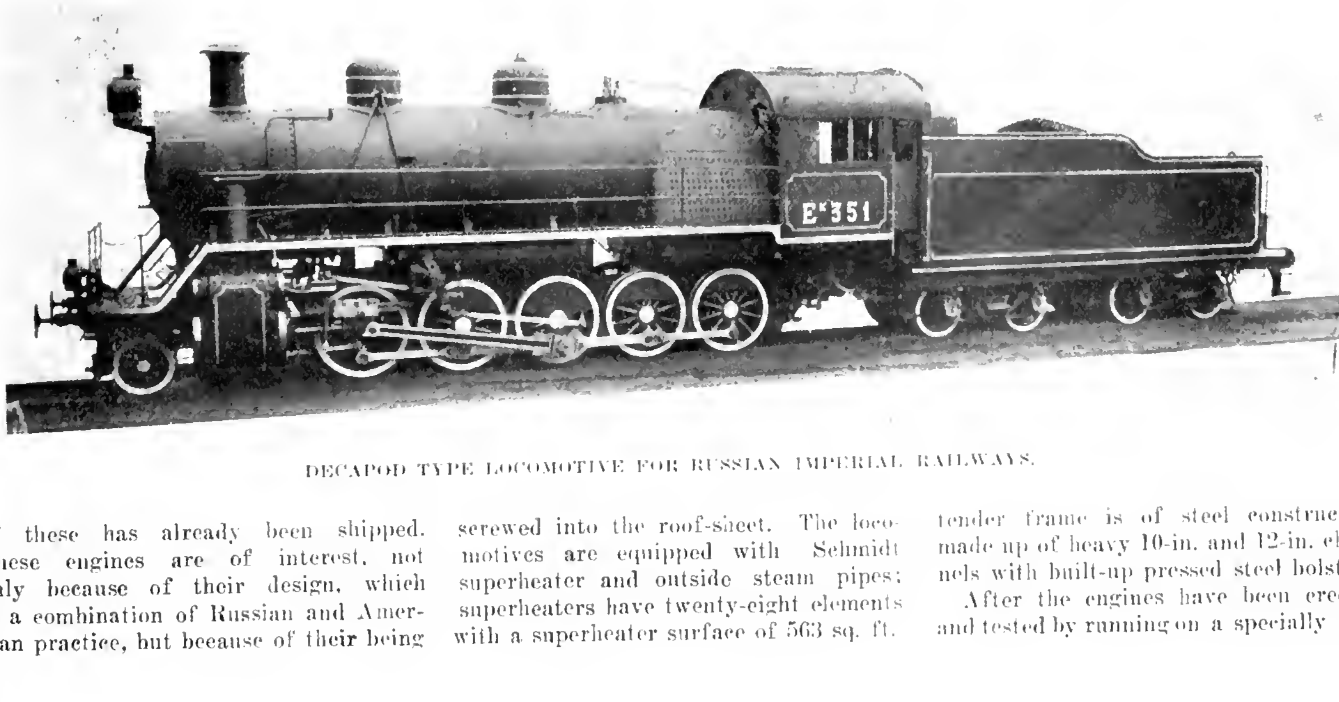
There is a wide running board of steel plate, diamond tread, having a handrail at the edges and continuing around the front deck plate in accordance with Russian railway practice.

The cab is of steel with side doors, and the front end of the tender is enclosed with a hood projecting under the cab of engine, protecting the crew from the weather. The couplers are of the hook and screw type of European practice, as are also the spring buffers. Russian-Westinghouse automatic air brakes are used, along with the special design of American Brake Co. foundation brake. A plug-type by-pass valve is fitted to the cylinder and is operated by a cam attached to the throttle lever, which in turn opens a globe valve allowing steam to pass to a small cylinder closing the by-pass. When steam is shut off, a tension spring opens the by-pass.

Tender

The tender is carried on two four-wheeled trucks of the arch-bar type with solid rolled steel wheels, the bearing and boxes being of the M. C. B. type. The tender frame is of steel construction made up of heavy 10-in. and 12-in. channels with built-up pressed steel bolsters.

After the engines have been erected and tested by running on a specially pre-



DECAPOD TYPE LOCOMOTIVE FOR RUSSIAN IMPERIAL RAILWAYS.

pared track by the builders, the locomotives and tenders are dismantled, crated and packed for shipment to Vladivostock, Russia. The principal dimensions of the locomotives and tenders are as follows:

General Data

Gauge, 5 ft.
Service, Freight.
Fuel, soft coal.
Tractive effort, 51,500 lbs.
Weight in working order, 192,000 lbs.
Weight on drivers, 172,000 lbs.
Weight of engine and tender in working order, 220,000 lbs.
Wheel base, driving, 18 ft. 8 in.
Wheel base, total, 27 ft. 10 in.
Wheel base, engine and tender, 60 ft. 1 in.

Ratios

Weight on drivers: Tractive effort, 3.34.
Total weight: Tractive effort, 3.73.
Tractive effort × diam. of drivers : equivalent heating surface, 780.
Equivalent heating surface : grate area, 53.4.

Cylinders

Type, Simple.
Diameter and stroke, 25 in. by 28 in.

Valves

Type, Piston.
Diameter, 12 in.

Wheels

Driving, diameter over tires, 52 in.
Driving journals, main, diameter and length, 10½ in. by 12 in.
Driving journals, others, diameter and length, 8½ in. by 12 in.

Boiler

Style, Straight.
Working pressure, 180 lb. per sq. inch.
Outside diameter of first ring, 70 in.
Firebox, length and width, 108⅛ in. by 86 in.
Tubes, number and outside diameter, 195 2-in.
Flues, number and outside diameter, 28 5⅜-in.
Tubes and flues, length, 17 ft.
Heating surface, tubes and flues, 2,393 sq. ft.
Heating surface, firebox (including arch tubes), 208 sq. ft.
Heating surface, total, 2,601 sq. ft.
Superheater heating surface, 563 sq. ft.
Equivalent heating surface, 3,446 sq. ft. Equivalent heating surface equals total evaporative heating surface plus 1.5 times the superheat surface.
Grate area, 64.5 sq. ft.

Tender

Tank, water bottom.
Frame, channel.
Wheels, diameter, 36 in.
Journals, diameter and length, 5⅛ in. by 10 in.
Water capacity, 7,400 gal.
Coal capacity, 8 metric tons.

OIL ENGINED COAL CARRIERS FOR GREAT LAKES

THE experiment which is about to be made on the Great Lakes with auxiliary oil-engined colliers will be watched, says Syren and Shipping, with interest by shipowners in the ocean trade. Since the outbreak of war the same idea has been given a new lease of life by owners on the British side of the Atlantic who have acquired a good many ocean-going windjammers and are fitting them with auxiliary engines. In the exceptional circumstances of the moment there is no doubt that the enterprises will be profitable — very profitable indeed — although it is doubtful if, when the conditions become normal, auxiliary ships will be able to live in competition with the large full-powered vessels which will be available.

At first sight the Great Lake experiments seem to have been induced by a sudden discovery of the hot-bulb engine's possibilities. As a matter of fact, however, through the withdrawal of steamers for ocean service much the same shipping position has been created on North America's great inland sea as exists elsewhere in the world. There is a shortage of tonnage, and in the circumstances the ordinary economic law which rules is inoperative.

What that economical law embodies is excellently illustrated by the New York paper which booms the new departure. "The old-fashioned 1,600-ton steamer went," it says, "to the scrap-heap long ago, for it could not carry enough, and discharging by primitive means was expensive. Bigger steamers, equipped with powerful steam winches, were built, and then bigger steamers yet with self-trimming devices, the latest of these carrying anywhere from 5,000 to 10,000 tons deadweight."

In view of that the average man will find it difficult to regard the future of auxiliaries "able to carry 4,000 to 5,000 tons" as rosy. Still, this is obviously a different problem from that which is in process of solution on Britain's side of the water. Schooner-rigged auxiliary vessels of this carrying capacity may cut into a good deal of the Great Lakes coal trade, and the type lends itself, especially in American hands, to very economical working. On this account shipowners will, we think, find a great deal in the experiments to interest them.

SHELLS FROM AUSTRALIA

ACCORDING to a report received through the High Commissioner for Australia, substantial progress is being made by manufacturers with the preparations for shell-making. High-explosive shells will, it is very probable, be turned out in Australia very soon, and shipments to Europe are expected to commence about the end of 1915. Further orders have, it is understood, been placed abroad for machinery, and the aggregate of the Australian orders to date will, according to good authority, fall little short of one million dollars. Other manufacturers are busy making lathes in their own workshops, but these will not be of the automatic type, and will require skilled labor.

The conditions laid down by the Federal Government fix the period of delivery as expiring on March 31, 1916. Manufacturers are taking exception to that limitation, it being claimed that the shells made prior to that date would not be sufficient to enable the initial expenses to be spread over a period long enough to leave any margin. Some machine-shop owners, who have contemplated laying out a considerable sum in new machinery, have deferred doing so pending an extension of this date, or some other basis being arrived at. One suggestion put forth is that, as the Imperial Government has notified its desire for as many shells as possible, manufacturers should be instructed to go ahead, on the understanding that the Government will give three months' notice when no more shells are required. The manufacture of gauges is now well in hand.

CANADIAN PULP AND PAPER EXPORT

THE high levels of Canadian pulp and paper exports continue to be well maintained, according to the latest export figures, which are for the month of September. While there is a contraction from the previous high marks, the falling off is so slight as to make no pronounced impression on the general growth of the business.

With a total of $1,207,460 for the month, newsprint exports aggregate $7,870,749 for the first six months of the current fiscal year. A year ago, for the same period, the total was $6,569,199, or $1,301,750 less than this year.

Newsprint trade with the United States, which, of course, is Canada's latest customer, totalled $1,099,369 for September, bringing the half year's total to $7,008,987, compared with $5,772,911 for the same period last year. To a very large extent this is a reflection of the better times the United States is enjoying, prosperity that finds expression in greater advertising of all kinds in the newspapers.

England and the colonies are increasing their trade with Canada. England's buying of our newsprint in six months this year totals $106,761, compared with $101,290. Australia's trade aggregates $306,143, compared with $298,576. New Zealand's imports are slightly down, be-

ing $149,661, as against in 1914, $154,810.

Canadian pulp mills benefited early in the present year from the strike in Northern York mills: in August the buying of Canadian chemical and mechanical pulp reached unprecedented proportions. There was slightly less demand for the Canadian product in September, however.

THIS WINTER'S LUMBER CUT

IT is stated that the lumber cut this winter will be at least fifty per cent. less than last year on account of a shortage in bottoms to carry the stuff from the New Brunswick ports, and also because the quantity carried over from last year is very much in excess of preceding winters. The price is a good deal higher for lumber, but steamers are so scarce on account of the war that the few chartered up to the present time indicate that the freight will be higher than the money received for the cargo itself. The demand in the United States for New Brunswick lumber has increased considerably, but here also the lack of vessels will interfere with the transportation.

It is believed that if the war were to stop suddenly, thus freeing a great many steamers now engaged in the transportation of troops and supplies, there would be a very considerable boom in the lumber trade of New Brunswick. Lumber will be in great demand in Europe, rebuilding what has been destroyed during the conflict.

MACHINERY MARKET IN CHINA

THE following particulars regarding methods of securing electrical and other machinery contracts in China have been furnished by T. M. Ainscough, the special commissioner appointed by the Board of Trade to inquire into the conditions and prospects of British trade in China:—

There would appear to be two clearly defined systems by which the large contracts in China, both Government and private, for the supply of plant and machinery can be secured. The first is that of appointing one of the large mercantile houses, having branches at all the important centres, as general agents on a fixed agreement for a term of years, and is the system employed by almost all the large German manufacturers of arms and munitions, industrial machinery, and electrical machinery and supplies.

Its principal advantage is that the manufacturer enjoys all the benefits accruing from the connections of an old-established firm ready to hand, offices in all the principal treaty ports, and valuable Chinese connections, in return for a fixed percentage of rebate on his prices to cover agency commission and expenses. In addition it would be advisable to send (say) four or five qualified engineers trained in the home works, preferably with some knowledge of Chinese, who would be attached to the principal centres in China, use the offices and staff of the agents and visit all provincial capitals, arsenals, mints, and other places where the demand for machinery warrants their attention. Unfortunately, at present, there are few British or colonial mercantile firms possessing a widespread organization embracing branches in all the principal treaty ports.

The other system is to conduct business direct with the Chinese, and open offices at four or five of the main centres, with qualified engineers attached, who are competent not only to draw up specifications and quotations on the spot, but to carry on with the help of a good Chinese staff lengthy negotiations with Chinese officials and native purchasers. It is a well-known fact in China that there is very little money to be made in laying down large electrical installations in that country. Most of the profit is derived from the supplies and accessories, and consequently German and American firms always endeavor to stipulate in the contract that renewals and supplies shall be purchased through the firm supplying the original installation.

United Kingdom makers have, as a rule, employed agents in one or two of the ports, but have not carried on a campaign all over China as large German firms have done. German firms have always worked with an eye to the future, and in cases where a plant was invaluable as an advertisement to Chinese and others, they were prepared to quote it at a loss to secure the contract. Examples of this may be found in the work executed for the municipal power station at Shanghai, the Shanghai native city tramways, and the Wuchang electrical installation.

INTERCOLONIAL RAILWAY BETTERMENT

ABOUT 10,000 tons of new steel have been laid during the year on the main system of the Intercolonial: about 20 per cent. of the main line is now laid with 85-pound steel, and this will be continued gradually until the whole of the main system is thoroughly modernized. During past administrations the last thing thought of was the condition of the roadbed, all the energy being used up in the maintaining of the system as a great political machine.

The bridges on the Intercolonial between Halifax and Montreal are now strong enough for the heaviest traffic. There was a new subway carried out in Moncton under Main street; new equipment was ordered, though this did not run up on to the millions, as was originally intended. The Intercolonial, however, is now a modern line giving a keen schedule and asking no favors, even if it is a government road, but soliciting business in competition with the other roads, and insisting that it is able to give an equal, if not a superior, service.

MONTREAL TRAMWAYS CO. IMPROVE AND EXTEND SYSTEM

IMPROVEMENTS in track construction and rearrangement of curves at congested corners have formed a considerable portion of the year's activities of the Montreal Tramway Co. According to general manager Hutchison, the sum of $500,000 had been spent from April 1st to October 31st in track laying alone.

A feature of this work has been the laying of tile pipes between the tracks for the purpose of carrying off water and preventing damage by frost. This work has been going on for some time till every foot of standard roadbed is now drained by porous French tile. The method of construction adopted is to lay broken stone, about one and a half inches in diameter, to a depth of eight to ten inches below the ties between which concrete is filled in, forming an elastic roadbed. The French tile which is six inches in diameter, is laid between each rail, carrying off the water and preventing the bulging of tracks when spring time comes.

The company's experience has shown this construction to be practically perfect, the only disturbances showing at complicated intersections.

Every congested intersection is now being perfected by the provision of more clearance on the curves, whereby 75 per cent. more cars can be handled than was formerly the case. Previously, cars could not pass on regular corner curves and the recent work has greatly facilitated handling of the traffic.

A considerable amount of work was done during the year on Notre Dame Street east, a double track now being extended as far as Pointe aux Trembles, which is only about four miles from Bout de l'Isle, although the old Terminal line is still being used from La Salle Ave. to the end of the island. It is understood, however, that the double track now stopping at Pointe aux Trembles, will be extended sooner or later right down to Bout de l'Isle, thus obviating the necessity of keeping the Terminal open, and, in fact, it is understood that the right of way now being utilized by the Tramway alongside the C.N.R. will one day belong permanently to the last named company's right of way.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey forge, Pittsburgh	$18 10	
Lake Superior, charcoal, Chicago	19 25	
Ferro nickel pig iron (Soo)	25 00	
	Montreal.	**Toronto.**
Middlesboro, No. 3	$24 00	.....
Carron, special	25 00	.....
Carron, soft	25 00	.....
Cleveland, No. 3	24 00	.....
Clarence, No. 3	24 50	.....
Glengarnock	28 00	.....
Summerlee, No. 1	30 00	.....
Summerlee, No. 3	29 00	.....
Michigan charcoal iron	28 00	.....
Victoria, No. 1	24 00	24 00
Victoria, No. 2X	23 00	24 00
Victoria, No. 2 plain	23 00	24 00
Hamilton, No. 1	23 00	24 00
Hamilton, No. 2	23 00	24 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	2.75
Steel bars, f.o.b., Toronto	2.75
Common bar iron, f.o.b., Montreal	2.50
Steel bars, f.o.b., Montreal	2.75
Twisted reinforcing bars	2.55
Bessemer rails, heavy, at mill	1.25
Steel bars, Pittsburgh	...
Tank plates, Pittsburgh	...
Beams and angles, Pittsburgh	...
Steel hoops, Pittsburgh	
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.75
Small shapes	2.75
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	2.20
Structural shapes	2.30
Plates	2.30

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal	Toronto
Plates, ¼ to ½ in., 100 lb.	$2 75	$2 75
Heads, per 700 lb.	3 00	3 00
Tank plates, 3-16 in.	3 00	3 00

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$13 75	$13 75
Copper, crucible	16 25	16 25
Copper, unch-bled, heavy	15 75	15 75
Copper, wire, unch-bled.	15 75	15 50
No. 1 machine compos'n	12 50	12 00
No. 1 compos'n turnings	11 00	10 00
No. 1 wrought iron	10 50	10 00
Heavy melting steel	9 50	9 50
No. 1 machin'y cast iron	13 50	13 00
New brass clippings	11 50	11 00
No. 1 brass turnings	9 50	9 00
Aluminum	32 00	29 00
Heavy lead	5 25	5 00
Tea lead	$ 4 25	$ 4 25
Scrap zinc	12 75	12 00

W. I. PIPE DISCOUNTS.

Following are Toronto jobbers' discounts on pipe in effect Dec. 14, 1915:

	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
Standard				
¼, ⅜ in.	60	36½	....	....
½ in.	65	45½	....	....
¾ to 1½ in.	70	50½	....	....
2 in	70	50½	66	46½
2½ to 4 in.	70	50½	69	49½
4½, 5, 6 in.	....	....	67	47½
7, 8, 10 in.	....	....	64	42½
X Strong P. E.				
¼, ⅜ in.	53	36½	....	....
½ in.	60	43½	....	....
¾ to 1½ in.	64	47½	....	....
2, 2½, 3 in.	65	48½	....	....
2 in.	....	....	60	43½
2½ to 4 in.	....	....	63	46½
5½, 5, 6 in.	....	....	63	46½
7, 8 in.	....	....	56	37½
XX Strong P. E.				
½ to 2 in.	41	24½	....	....
2½ to 6 in.	....	....	40	23½
7 to 8 in.	....	....	37	18½
Genuine Wrot Iron.				
⅜ in.	54	30½	....	....
½ in.	59	39½	....	....
¾ to 1½ in.	64	44½	....	....
2 in.	64	44½	60	40½
2½, 3 in.	64	44½	63	43½
3½, 4 in.	....	....	63	43½
4½, 5, 6 in.	....	....	60	40½
7, 8 in.	....	....	57	35½

Wrought Nipples.

4 in. and under	75%
4½ in. and larger	70%
4 in. and under, running thread	55%

Standard Couplings.

4 in. and under	57½%
4½ in. and larger	37½%

MILLED PRODUCTS.

Sq. & Hex Head Cap Screws	65 & 5%
Sq. Head Set Screws	70 & 5%
Rd. & Fil. Head Cap Screws	45%
Flat & But. Head Cap Screws	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in.	70%
Semi-Fin. Nuts up to 1 in.	70%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

METALS.

	Montreal.	Toronto.
Lake copper, carload	$22 00	$21 25
Electrolytic copper	21 75	21 00
Castings, copper	21 25	20 75
Tin	45 00	43 00
Spelter	21 00	19 00
Lead	6 85	7 00
Antimony	42 00	40 00
Aluminum	68 00	65 00

Prices per 100 lbs.

BILLETS.

	Per Gross Ton
Bessemer billets, Pittsburgh	$32 00
Open-hearth billets, Pittsburgh	33 00
Forging billets, Pittsburgh	52 00
Wire rods, Pittsburgh	40 00

NAILS AND SPIKES.

Standard steel wire nails, base	$2 80	$2 85
Cut nails	2 90	2 90
Miscellaneous wire nails	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	3 25	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	65 and 5
Stove bolts	82½
Plate washers	40
Machine bolts, ⅜ and less	60
Machine bolts, 7-16 and over	50
Blank bolts	50
Bolt ends	50
Machine screws, iron, brass	35
Nuts, square, all sizes	3¼c per lb. off
Nuts, hexagon, all sizes	3½c per lb. off
Iron rivets	67½
Boiler rivets, base, ¾-in. and larger	$4.00
Structural rivets, as above	4.00
Wood screws, flathead, bright	85 p.c. off
Wood screws, flathead, brass	62½ p.c. off
Wood screws, flathead, bronze	57½ p.c. off

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Standard. Price. per ft.	Extra Strong, Sizes Ins.	Extra Strong, Price per ft.	D. Ex. Strong, Size Ins.	D. Ex. Strong, Price per ft.
⅛in	$.05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	....
7 in	2.38	7 in	3.81	....	....
8 in	2.50	8 in	4.34	....	....
8 in	2.88	9 in	4.90	....	....
9 in	3.45	10 in	5.49	....	....
10 in.	3.20	....	....	....	....
10 in.	3.50	....	....	....	....
10 in.	4.12	....	....	....	....

COKE AND COAL

Solvay Foundry Coke	$6.50
Connelsville Foundry Coke	5.95
Yough Steam Lump Coal	3.98
Penn. Steam Lump Coal	3.88
Best Slack	3.25

Net ton f.o.b. Toronto.

COLD DRAWN STEEL SHAFTING.

At mill	25%
At warehouse	20%

Discounts off new list. Warehouse price at Montreal and Toronto.

MISCELLANEOUS

Solder, half-and-half	0.23½
Putty, 100-lb. drums	2.70
Red dry lead, 100-lb. kegs, per cwt.	9.65
Glue, French medal, per lb.	0.15
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.27½
Benzine, single bbls., per gal.	0.27
Pure turpentine, single bbls.	0.87
Linseed oil, raw, single bbls.	0.87
Linseed oil, boiled, single bbls.	0.90
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.50
Lead Wool, per lb.	0.11
Pure Manila rope	0.16
Transmission rope, Manila	0.20
Drilling cables, Manila	0.17
Lard oil, per gal.	1.10
Union thread cutting oil	0.60
Imperial quenching oil	0.35

POLISHING DRILL ROD

Discount off list, Montreal and Toronto 40%

PROOF COIL CHAIN.

¼ in.	$9.00
5-16 in.	5.90
⅜ in.	4.95
7-16 in.	4.55
½ in.	4.00
9-16 in.	4.20
⅝ in.	4.10
¾ in.	3.95
⅞ in.	3.80
1 inch	3.70

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	55
Carbon over 1½ in.	25
High Speed	
Blacksmith	55
Bit Stock	60 and 5
Centre drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Centre	25
Pipe Reamers	80

Discounts off standard list.

IRON PIPE FITTINGS.

Canadian malleable, A, 25 per cent.; B and C, 35 per cent.; cast iron, 60; standard bushings, 60 per cent.; headers, 60; flanged unions, 60; malleable bushings, 60; nipples, 75; malleable, lipped unions, 65.

TAPES

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3.50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$3 50	$3 50
Canada plates, dull. 52 sheets	3 25	3 25
Canada Plates, all bright	4 60	4 75
Apollo brand, 10¾ oz. galvanized	5 50	5 50
Queen's Head, 28 B.W.G.	6 00	6 00
Fleur-de-Lis, 28 B. W. G.	5 75	5 75
Gorbal's Best, No. 28	6 10	6 10
Viking metal, No. 28	5 25	5 25
Colborne Crown, No. 28	5 70	5 80
Premier No. 28	5 40	5 50
Premier, 10¾ oz.	....	5 75

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$14 25	.....
1¼ in.	15 00	.....
1½ in.	15 00	.....
1¾ in.	15 00	.....
2 in.	15 00	10 00
2¼ in.	16 50	11 00
2½ in.	17 50	12 85
3 in.	25 00	13 20
3½ in.	28 00	16 25
4 in.	33 00	20 75

Prices per 100 feet, Montreal and Toronto.

WASTE.

WHITE.	Cents per lb.
XXX Extra	0 12½
X Grand	0 11¾
XLCR	0 11
X Empire	0 10¼
X Press	0 09½
COLORED.	
Lion	0 08¼
Standard	0 07½
Popular	0 06¾
Keen	0 06
WOOL PACKING.	
Arrow	0 20
Axle	0 14
Anvil	0 10
Anchor	0 08
WASHED WIPERS.	
Select White	0 08½
Mixed Colored	0 06¼
Dark Colored	0 05¼

This list subject to trade discount for quantity.

BELTING RUBBER

Standard	50%
Best grades	30%

BELTING—NO. 1 OAK TANNED.

Extra heavy, single and d'ble, 40 & 10%	
Standard	50%
Cut leather lacing, No. 1	$1.25
Leather in sides	1.10

ELECTRIC WELD COIL CHAIN B.B.

⅛ in.	$12.75
3-16 in.	8.85
¼ in.	6.15
5-16 in.	4.90
⅜ in.	4.05
7-16 in.	3.85
½ in.	3.75
⅝ in.	3.60
¾ in.	3.60

Prices per 100 lbs.

PLATING CHEMICALS

Acid, boracic	$ .15
Acid, hydrochloric	.05
Acid, hydrofluoric	.06
Acid, nitric	.10
Acid, sulphuric	.05
Ammonia, aqua	.08
Ammonium carbonate	.15
Ammonium chloride	.11
Ammonium hydrosulphuret	.35
Ammonium sulphate	.07
Arsenic, white	.10
Copper sulphate	.10
Cobalt sulphate	.50
Iron perchloride	.20
Lead acetate	.16
Nickel ammonium sulphate	.10
Nickel carbonate	.50
Nickel sulphate	.15
Potassium carbonate	.40
Potassium sulphide (substitute)	.20
Silver chloride (per oz.)	.65
Silver nitrate (per oz.)	.45
Sodium bisulphite	.10
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.35
Sodium hydrate	.04
Sodium hyposulphite (per 100 lbs.)	3.00
Sodium phosphate	.14
Tin chloride	.45
Zinc chloride	.20
Zinc sulphate	.07

Prices Per Lb. Unless Otherwise Stated.

ANODES

Nickel	.47 to .52
Cobalt	1.75 to 2.00
Copper	.22 to .25
Tin	.45 to .50
Silver	.55 to .60
Zinc	.22 to .25

Prices Per Lb.

PLATING SUPPLIES

Polishing wheels, felt	1.50 to 1.75
Polishing wheels, bullneck.	.80
Emery in kegs	4½ to .06
Pumice, ground	.05
Emery glue	.15 to .20
Tripoli composition	.04 to .06
Crocus composition	.04 to .06
Emery composition	.05 to .07
Rouge, silver	.25 to .50
Rouge, nickel and brass	.15 to .25

Prices Per Lb.

Review of the Past Year's Steel, Iron and Metal Markets

Staff Article

Prosperity is rampant so far as the production of steel and iron is concerned, and, only in some lesser degree does a like condition exist relative to the more prominent metals. Prices of all may be said to have pyramided to extreme heights, and, while in a number of instances some recession has taken place, it will be found that the upward trend continues general.

IRON AND STEEL

THE conditions prevailing in the iron and steel trade at the close of the year 1915 are the most extraordinary that have ever been experienced in the history of the trade in Canada. At the beginning of the year business was dull, and only the most optimistic expected any great improvement, the basis for the latter being the possibility of increased export business to markets hitherto largely supplied from Germany. A hope was generally expressed that Canadian steel companies might be able, by means of a great effort, to capture some of the foreign business likely to develop as a result of the war. As events turned out, the business came to Canada, but in a rather different form than was anticipated. There still remains, however, the possibility of hopes being realized, and Canadian steel companies may be successful in the open market for such products as they can manufacture when the war is over.

Munition Demand the Main Factor

The cause of the present unparalleled prosperity in the steel trade is, of course, the enormous demand for munitions. It was not, however, until about the middle of July that the advance in prices of raw and semi-finished materials began, although for some months previously a large number of shells had been made and the output of steel had been increasing. The mills at the beginning of the year were quiet, and were thus in a position to handle a considerable tonnage without much difficulty, and by installing forging presses were able to meet the demand for shells for some time. Eventually the need for munitions became so urgent that the mills were soon operating at capacity, and have since been obliged to make large extensions to their plants. During the first half of the year business was gradually working up to a normal condition. After that, with the heavy increase in demand for munitions, came the extraordinary activity in the trade which still exists. The need for steel has become so great that Canadian mills cannot supply the demand, and a considerable tonnage has been imported from the States.

Steel Famine Possible

With a shortage of steel, it was obvious that prices would advance, and since July the market has been gradually rising, until prices have reached a level never before attained in this country. The close affinity between this market and that of the States has been clearly demonstrated during the year, and higher prices at Pittsburg have at all times been followed by an equivalent advance here. About the middle of November there was an important development in the steel trade, when the United States Steel Corporation withdrew prices on steel bars for Canadian consumption. This action was taken on account of the inability of the mills to fill orders or make any definite promise of delivery. Existing contracts were filled, but no new business was solicited. For some time previous to this, the mills in the States had been booked up with orders for tonnage from Europe, and had been rapidly getting behind on deliveries.

Activity in Futures

At the present time orders are being taken for delivery into the second half of 1916, and this activity in futures is almost entirely owing to the heavy demand for munitions. As long as present conditions prevail in the steel trade in the States there is practically no possibility of the Steel Corporation resuming their former connection in this market. The result of this may be serious, as it is estimated that Canada imports about half its steel requirements from the States, and with the demand increasing all the time, it follows that a serious shortage may develop. The rapid increase in prices of billets is another indication of the shortage of steel. In less than six months Bessemer and open-hearth billets have advanced about $10 per ton, while forging billets have doubled in price.

High Prices General

The effect of the high price and scarcity of steel has been widespread, and the natural result has been an increase in cost of finished steel products covering a wide range. Sheets and wrought iron pipe are two lines which have been affected, and have been gradually advancing for some months. All lines of bolts, nuts and rivets have advanced, while higher prices for boiler tubes and boiler plates have been recorded on more than one occasion. In fact, all steel products have advanced, and there is every indication that higher prices will yet prevail. Another feature which had an almost immediate effect on prices was the increase of 7½ per cent. in the tariff last March. The market had, however, become adjusted to the new conditions before the upward movement started in July, and the increased tariff was almost forgotten in the excitement which followed later.

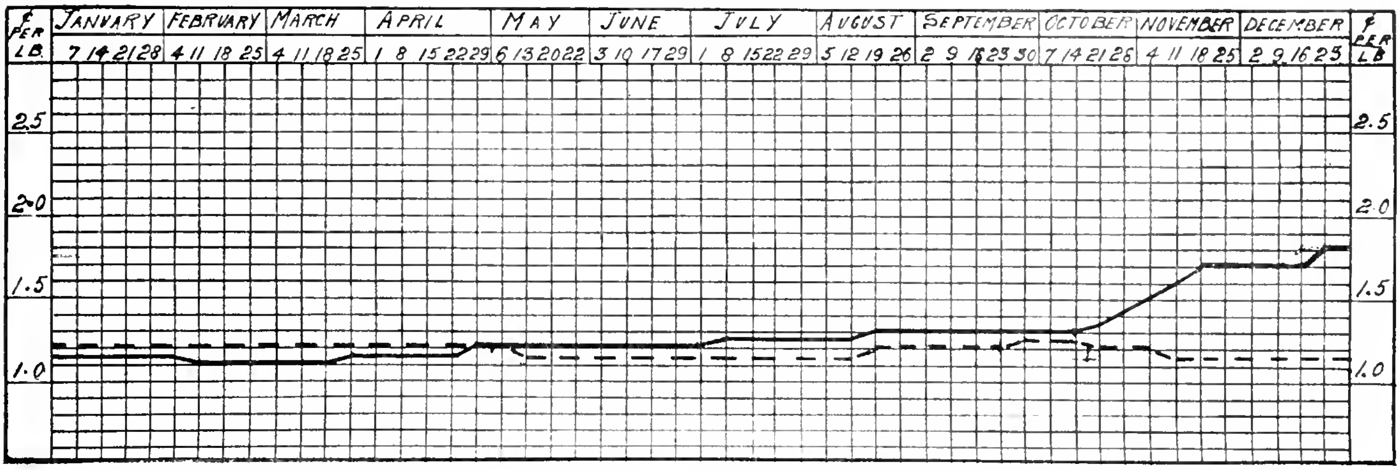
Domestic Purpose Steel

The demand for steel for domestic requirements has been for the most part light, although there has been some improvement in this regard during the second half of the year. Factory and shop extensions have created some business in small shapes, but the building trade generally has been dull. The financial stringency during the entire year has seriously affected the building trade on account of high rates of interest charged on loans and the uncertainty as to future developments. A certain lack of confidence has been noticeable, more especially during the early part of the year, and the general contraction in ordinary business and decrease in values were not calculated to improve conditions in the building trade or develop interest in building propositions.

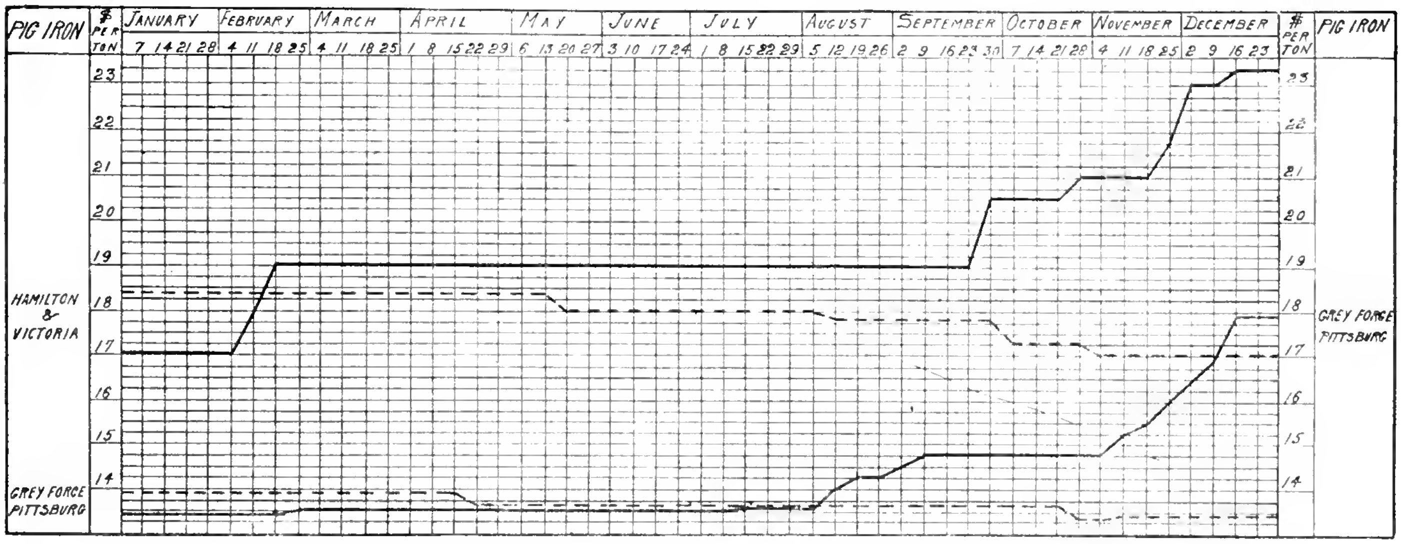
The difficulty of raising money has made it necessary for municipalities to exercise rigid economy on civic works. There has, therefore, been comparatively little cast iron or steel pipe laid down this year. Railways have reduced their maintenance expenditure to a minimum and track extensions have been very much curtailed. The demand for rails and other steel products used in railway construction and equipment has, therefore, been considerably less than in normal times. The steel companies have not felt the loss of this business this year as they did during 1914, as their plants have been turned over almost entirely to the production of steel for munitions. One steel plant, in addition to a large munition business, has rolled a large quantity of wire for military purposes.

Steel Plant Extensions

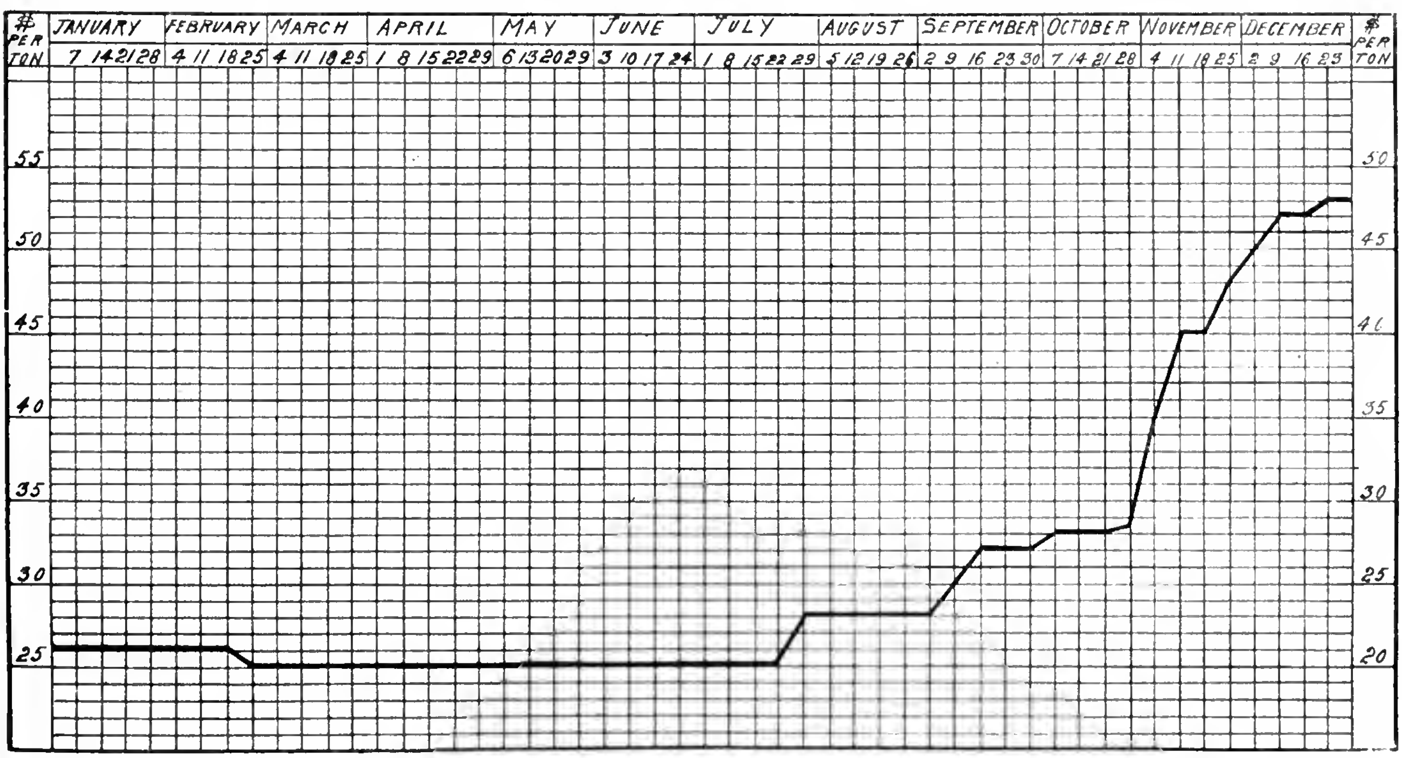
A feature of the present boom is the large extensions which practically all the steel companies have made to their plants. These extensions have cost large sums of money, for in addition to the buildings, open-hearth furnaces and rolling mills have been installed with all the necessary and costly equipment. The Dominion Steel Corporation, the Nova Scotia Steel & Coal Co., and the Steel Company of Canada have all incurred heavy expenditures in extending their plants to meet the enormous demand for steel for munitions. These concerns have also installed heavy type forging



PRICE FLUCTUATIONS OF BARS, PLATES AND SHAPES AT PITTSBURGH DURING 1915. DOTTED LINES SHOW 1914 PRICES.



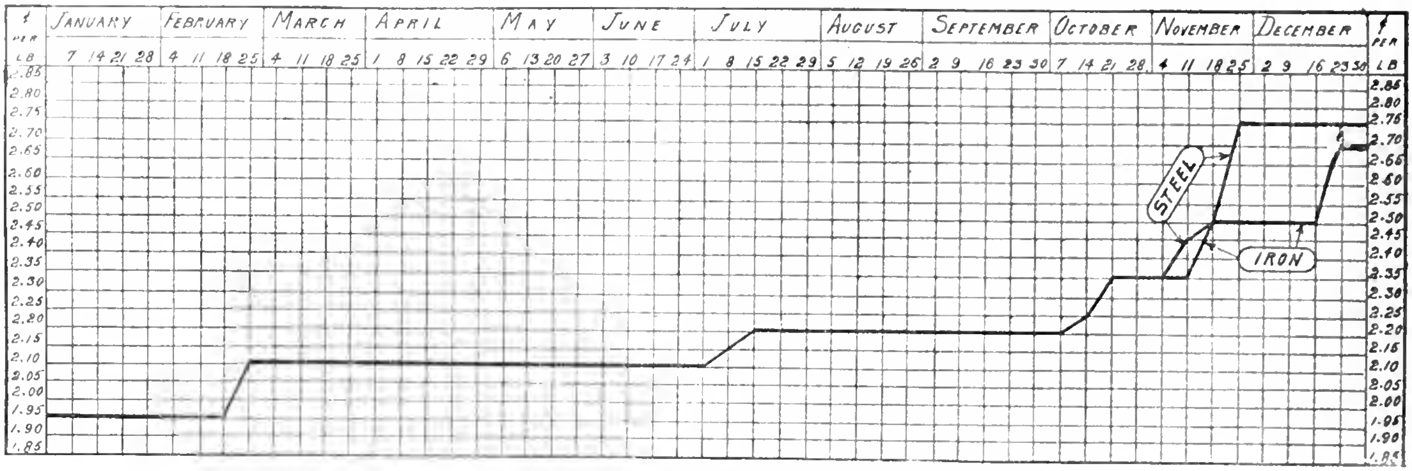
PRICE FLUCTUATIONS OF CANADIAN AND AMERICAN PIG IRON DURING 1915. DOTTED LINES SHOW 1914 PRICES.



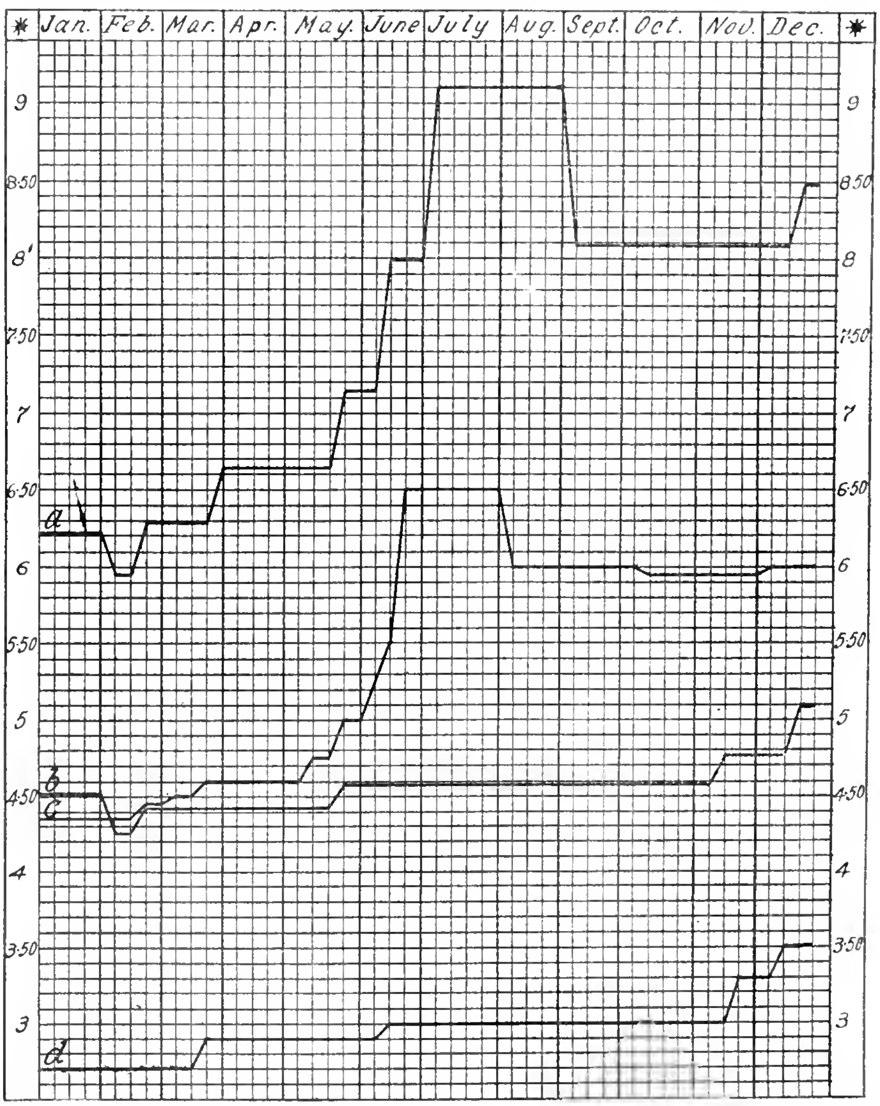
PRICE FLUCTUATIONS OF FORGING BILLETS AT PITTSBURGH DURING 1915.

presses for the production of shell cases. The Algoma Steel Co. was for some time very busy on rail orders, but latterly has also been engaged on the production of steel for shells. During the year an industry closely associated with the steel trade was established in Hamilton, Ont., for making galvanized sheets. The concern in question, the Dominion Sheet Metal Co., installed a plant for galvanizing sheets, the first plant of its kind to be operated in Canada.

Judging from appearances, there is every probability of the present era of prosperity being continued for several months yet. How long it will last depends entirely upon the duration of the war. It is reasonable to suppose that while the war lasts the steel trade will be active; what will happen after that is a matter of conjecture. It is to be hoped that the Canadian steel companies will be able to extend the scope of their business and participate in the large demand for steel products that it is generally believed will exist in Europe after the war and during the period of reconstruction. From a financial standpoint the steel companies have made large profits and are in a sound condition. This should go a long way towards helping them to extend their connections, and enable them to lay down plants for making products which have not heretofore been made in Canada.



PRICE FLUCTUATIONS OF DOMESTIC IRON AND STEEL BARS DURING 1915.



PRICE FLUCTUATIONS OF 1-INCH IRON PIPE PER 100 FEET, AND 28 GAUGE IRON SHEETS PER 100 LBS. DURING 1915.

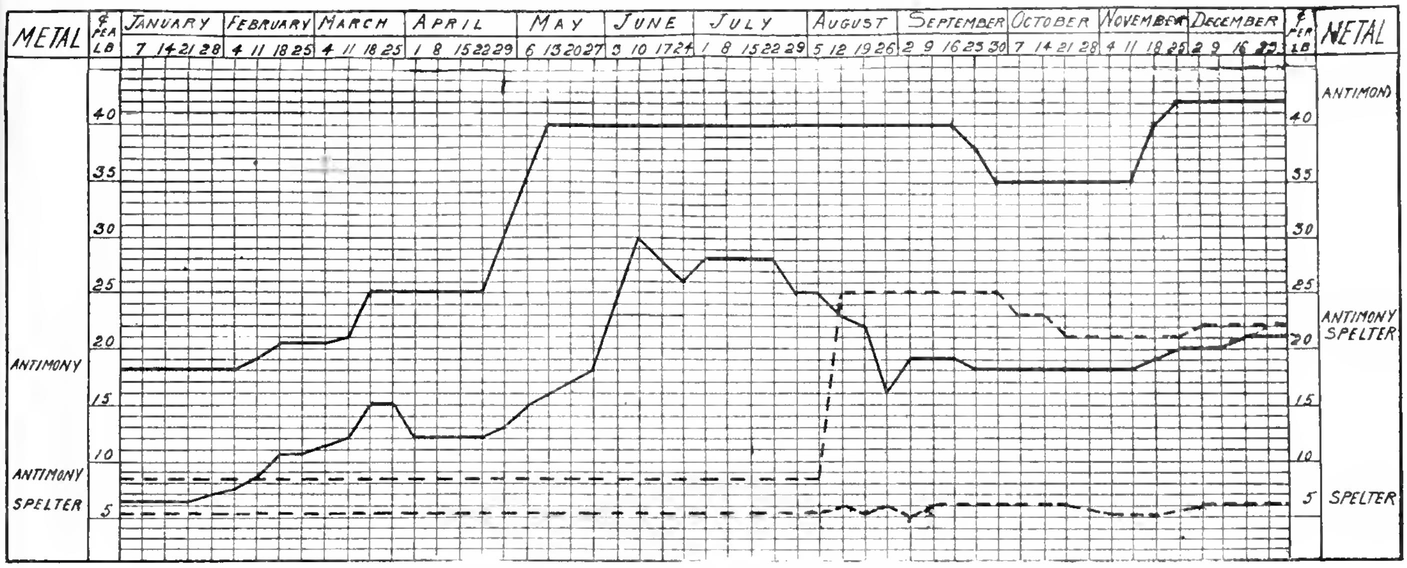
(a)—Galvanized Pipe; (b)—Black Pipe; (c)—Galvanized Sheets; (d)—Black Sheets.

METALS MARKET

THE metals market has during the entire year been very much influenced by war conditions. This is naturally what might have been expected, but it is doubtful whether at the beginning of 1915 any among those interested anticipated such fluctuations as developed in the succeeding months. The enormous demand for munitions alone eventually became far greater than was expected, and, therefore, a correspondingly heavy consumption of metals for their manufacture resulted. The metals particularly affected were copper, lead, antimony, and spelter. Copper and lead did not fluctuate to the same extent as the others mentioned, because production was increased to take care of the consumption, and there was never at any time any marked scarcity. Antimony at the beginning of the year was at a high level, but, as supplies became very scarce, the price advanced to more than double the figure prevailing in January. The spelter market has been very erratic, and speculation has on more

than one occasion driven prices upward. The usual recession followed, thus causing many and wide fluctuations.

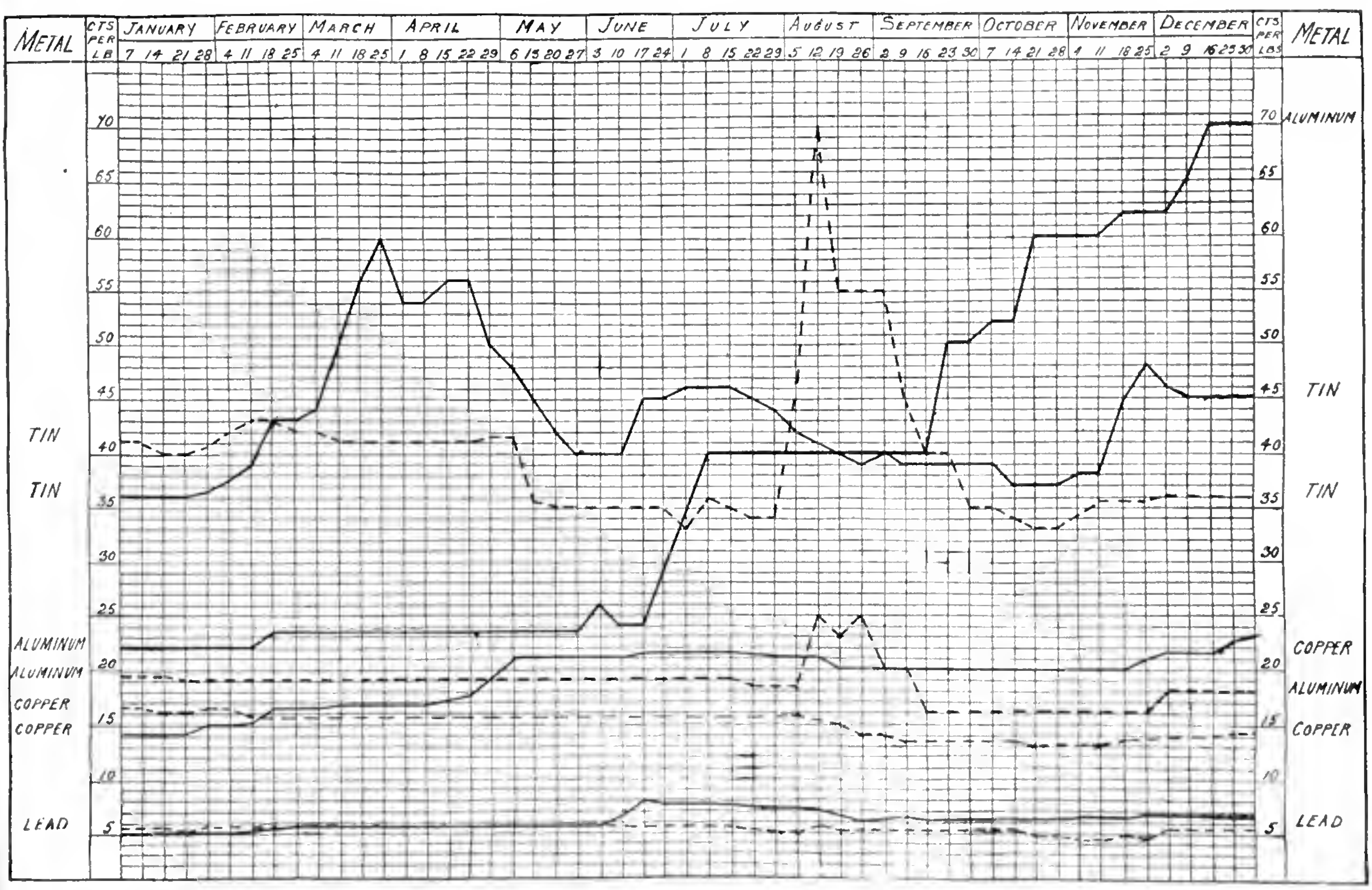
As in the previous year the tin market has been erratic and a wide range of prices has been the logical result. Tin has been affected by the war, but not in the same sense as copper or antimony. The tin market was affected more by the possibility of supplies being unobtainable rather than any extraordinary demand. The aluminum market for some months was very steady, but about the middle of the year a scarcity of this metal began to be experienced. This has affected the market more and more, until the price at the end of the year has reached three times what it was at the beginning. The close of the year finds producers extremely active. Many old refining plants have been requisitioned and more modern plants have been extended to take care of the demand. In many cases old workings that ceased to pay are in operation.



PRICE FLUCTUATIONS OF ANTIMONY AND SPELTER DURING 1915. DOTTED LINES SHOW 1914 PRICES.

Tin

During the latter part of 1914 the tin market was affected by the loss of cargoes at sea, some ships being sunk by enemy cruisers. This year there has been no recurrence of these conditions, but the market has fluctuated considerably, especially about the end of March, when the highest level was reached. In the early part of the year the British Government placed an embargo on tin shipments, except under very stringent



PRICE FLUCTUATIONS OF TIN, ALUMINUM, COPPER AND LEAD DURING 1915. DOTTED LINES SHOW 1914 PRICES.

conditions. This at the time unsettled the market, especially in New York, as it had a tendency to delay shipments and also create uncertainty as to the obtaining of sufficient quantities. The market on this account was very firm for a while and prices high. The situation in time became considerably easier and the market steadier. The trade routes from the East have been open all the year, and shipments of tin have been coming forward regularly, until now stocks on hand are amply sufficient to meet the demand. Some excitement was caused about the end of November when an unfounded rumor to the effect that the Suez Canal had been closed caused a sharp advance, but the market soon weakened and prices dropped.

It must be admitted that there is a possibility of the canal being closed for military reasons, in which case shipments of tin would be delayed from three to four weeks coming round by the Cape. Such a contingency, however, would not seriously interfere with spot supplies, but would no doubt cause prices to jump up, especially if the market was at all nervous. Considering the conditions prevailing last January the market was not particularly high, and during the whole of that month was steady at 36c. During the month of February prices advanced to 43c, and by the end of March had jumped to 60c, the highest level of the year. The market at the time being largely speculative, and with no backing, prices soon began to decline and by the end of May tin was being quoted at 40c per pound. Towards the end of June the price again advanced to 45c, and in July to 46c. afterwards gradually falling to 39c. this level being practically maintained until early in October, when it fell again to 37c. During November the Suez Canal scare caused another sharp advance to 48c which was followed by a steady decline. finishing the year at 45c.

Copper

Copper, being one of the most important metals used in the manufacture of munitions, has naturally attracted considerable attention during the year. The market has. considering the conditions prevailing, been remarkably steady, registering a range of only seven points for the entire year. As the year progressed. the consumption increased until eventually all records were broken and production reached the highest point ever. The position of copper has been a particularly strong one throughout the year, and there is no doubt but that it will be maintained while the war lasts. The copper situation was for a time unsettled, as being a contraband of war. supplies which had hitherto been going to Germany through neutral countries were eventually stopped by the British Government making certain arrangements with those countries. The market was in consequence affected, as several important shipments were held up pending decisions of the British Prize Court established for the purpose of dealing with contraband cargoes captured at sea. In time the situation was straightened out. and there has been little trouble recently from this source.

At the beginning of the year the price of copper was just over 14c. The market soon became stronger and the price advanced gradually. About the middle of April the price rose rapidly, and early in May, 20c was reached. Towards the end of June the market advanced to 20½c. and this level was maintained until the end of July, when it dropped back to 20c, and again about the middle of August to 19c. This level was maintained until the end of November when the market became stronger, and prices gradually advanced to 21½c which level was maintained until the end of the year. The market finished the year firm with every prospect of higher prices at the next buying movement. An interesting feature in the copper market during the year has been the decision of the Canadian Government to assist in the development of copper refineries in Canada. A special commission was appointed to investigate the possibilities of operating refineries on a commercial scale. Success in this direction will help in no small measure to lower the production cost. as hitherto practically all copper mined in Canada has had to be refined in the States.

ALLIES PURCHASING AGENTS

The Trade and Commerce Department, Ottawa, has published the following list of purchasing agents for military purposes for the allied Governments:

International Purchasing Commission, India House, Kingsway, London, Eng.

French.—Hudson Bay Co., 56 McGill Street, Montreal; Captain Lafoulloux, Hotel Brevort, New York; Direction de l'Intendence Ministere de la Guerre, Bordeaux, France; M. De la Chaume, 28 Broadway, Westminster, London.

Russian.—Messrs. S. Ruperti and Alexsieff, care Military Attache, Russian Embassy, Washington, D.C.

Spelter

The market has been very unsettled for the greater part of the year, and has been influenced largely by speculation. There has been a very heavy demand for spelter for munitions but consumption fell off for ordinary uses. The high price of spelter has seriously affected several trades. particularly galvanized sheets, some makers having practically withdrawn from the market on this account. Outside of the United States. the principal sources of supply were Belgium and Germany. With no spelter coming from either of these countries, the demand centred on the States with the result that the mines there have been extremely active, and the industry has been booming. Zinc ore, a few months ago reached the unprecedented price of $100 per ton at Joplin, Mo., and later touched $110 per ton. A record such as this indicates to some extent the effect which the war has had on this industry. Notwithstanding the heavy consumption of spelter there has been nothing to warrant the sharp fluctuations that have taken place, the market having on more than one occasion run wild. The high price of primary spelter, the grade used in making cartridge cases, did not affect the general situation to such an extent as the high cost of the lower grades, the latter being used in industries where the cost of spelter is an important consideration.

The price at the beginning of the year under review was practically normal but it did not stay long at that level. At the end of January it began to advance. and by the end of March spelter was quoted at 15c. A sharp decline to 12c followed. and the market was steady until the end of April. when it strengthened and the price again advanced sharply, touching 30c in the middle of June. the highest level attained during the year. A sharp reaction occurred. and the price fell to 26c at the end of June. but the market recovered immediately. advancing to 28c, where it remained until the end of July. The market then suffered a sharp break and prices tumbled until the end of August when a 16c level was reached. The price jumped back to 19c during September. and then dropped one point to 18c, where it remained until the middle of November. At the beginning of December. the market was firm at 20c. and about the middle of the month advanced to 21c, which quotation was maintained until the close of the year.

Lead

An enormous quantity of lead has been consumed during the year largely in the manufacture of munitions. but with the exception of a sharp fluctuation in June, the market has been very steady. The position of this metal has been generally a strong one. As the consumption increased so did production, and conditions have been for some time fairly well balanced. The control of the market by the "Trust" in New York. has been an important factor in the stability of lead,

"Independent" quotations being usually pretty close to the "Trust" figures. The price of lead is now higher than the average for any year since 1907, but considering the conditions prevailing, this is only what might be expected. As will be gathered from the above there is nothing of particular imprtance to note with regard to price fluctuations. An advance from 5c to 6¾c during the greater part of the year with a sharp advance to 8c in June were the principal features.

Aluminium

The increasing utility of aluminium has been clearly demonstrated during the year just closing. The demand for this metal has been out of all proportion to the supply as it is being used to a large extent in the manufacture of war equipment. The aluminium produced in Great Britain is being entirely absorbed in that country. The output in the States is controlled by a "Trust" who also have properties in Canada, and the total aluminum production in the States and Canada for 1915, has been estimated at about 50,000 tons or nearly double that of 1914. At about the half-year a scarcity of aluminium developed which became more acute as the year progressed. The market consequently became very strong and prices have been more or less nominal

The average price of aluminum during 1914 was about 18½c per pound. At the beginning of 1915 the price was 22c, not particularly high considering that the war had been in progress about five months. The market was comparatively steady until early in June when it began to move and advanced about 2½c to 26c, reacting immediately to 24c. The real movement began about the end of that month when the price jumped to 40c, staying at that level until the middle of September. The scarcity of aluminium then became serious, it being practically impossible to get the metal. Prices consequently continued to advance rapidly until a range of 65c to 70c was reached about the middle of December which level has since been maintained.

Antimony

The position of antimony has of course been greatly affected by the war, as large quantities of it have also been used in the manufacture of munitions. In fact so great was the consumption of this metal that a scarcity developed early in the year, and prices naturally advanced to unprecedented levels. English antimony has been off the market for several months and the British Government early in the year assumed control of that market. This action was taken in order to secure and conserve the supply. Large quantities of antimony are being shipped from China and Japan, while in the States the industry has recently developed, and antimony is now being obtained from American ores.

A glance at the diagram will show clearly the big advance which antimony has made during 1915, the average price in normal times being about 8c to 9c per pound. At the beginning of this year antimony was quoted at 18c, a little better than the highest monthly average for 1914. The market began to move early in February, and climbed steadily to 25c at the end of April, jumping up to 40c in the middle of May. The market remained steady at this level until the middle of September when it weakened, the price dropping to 35c at the beginning of October. This level was maintained until the middle of November when the market became stronger and prices advanced to 42c in the latter part of the month. Since then the market has shown a weaker tendency but prices have been maintained at the above level.

CANADIAN PURCHASES FOR FRENCH WAR OFFICE

Philippe Roy, General Commissioner for Canada, Paris, advises the Department of Trade and Commerce, Ottawa, that an order has been issued by the War Department of the French Government to the effect that all purchases made by the Supply Branch in Canada will pass through the Hudson Bay Co. Canadian producers should therefore submit their future offers through the office of that company at Montreal. It is further stated in Mr. Roy's communication that Canadian lumber, steel and meat will find in France an important market for years to come, but it is necessary that Canadian firms should have in Paris representatives entrusted with the necessary authority, especially if it is desired to secure Government contracts.

HIGH-SPEED TOOL STEEL SITUATION

The situation in regard to high-speed tool steel has become acute and great difficulty is being experienced in obtaining supplies in sufficient quantities to satisfy immediate requirements. The two causes which have largely contributed to this situation are the scarcity of ferro-tungsten and the big consumption of tool steel. Ferro-tungsten gives to high-speed steel its peculiar characteristics and was formerly obtained in considerable quantities from Germany; this source of supply is now, of course, cut off. Tungsten is also obtained in important quantities from Burma and in a lesser degree from the United States, but owing to the peculiar conditions associated with the mining of tungsten, progress has been slow in increasing production to the extent necessary to keep pace with the consumption. The manufacture of tungsten powder has been developed in England during the present year, and has helped to some extent to relieve the situation. The demand for tungsten has increased at a greater rate than production, hence the scarcity.

During the first few months of the year supplies of high-speed tool steel were fairly easy to obtain, but eventually the demand increased to such an extent that a serious shortage developed. Owing to the enormous demand in Great Britain for tool steel for munition plants, the British Government practically prohibited the export of high-speed steel, thus cutting off to a large extent one source of supply. Stocks in Canada were soon depleted and prices advanced rapidly. In the States the demand also increased, as a large number of plants were engaged in making munitions. Steel makers in that country were thus unable to fill all orders from Canada as the domestic consumption was also increasing rapidly and taxing the capacity of the mills to the limit. The makers got behind on their orders and consumers had to be contented with what they could get regardless of price. The question of price did not, however, cut much of a figure as practically all the steel was required for munition plants.

As already stated, prices advanced rapidly. High-speed tool steel averaged about 60c per pound in the early stages of the war, but, as the demand developed, prices advanced, and to-day high-speed tool steel costs anywhere from $2.75 to $3.10 per pound. At the close of the year the situation is much the same as prevailed during the last quarter, although the shortage has probably become more acute. The makers of steel have meantime extended their plants, production has therefor increased considerably and will probably at no very distant date catch up with consumption. The probability is that the situation will gradually improve during the first half of 1916, as supply and demand will be more evenly balanced.

Safety First.—British Columbia paper and pulp mills will shortly introduce safety first schedules and devices. A committee has recently been investigating conditions in the Wisconsin mills with that object in view.

RECORD ORDER FOR COPPER

REPRESENTATIVES of the British Government on Dec. 22 signed a contract with United States copper producers for 135,000,000 pounds of metal, the largest single order ever placed in this country. The Anaconda Copper Mining Co., the American Smelting & Refining Co., and the Tennessee Copper Co. were the principal concerns to share in the order. The Anaconda, it is said, got the bulk of the contract.

The price was close to 21 cents a pound, the highest price paid in New York for more than five years. Payment for the order in full will amount to over $28,000,000 and the sellers will receive cash as the copper is delivered. The contract provides for delivery at the direction of the British Government, and the metal will be placed within the next year.

Usually contracts for round amounts of copper call for monthly deliveries, but the buyer in this case may ask for five million pounds next February, say, none in March, and fifteen million in April. Owing to this provision, it was understood the price was fractionally higher than current quotations for electrolytic copper, which ruled on the above date around 20½ cents per pound.

While no other item of business has approached this in the copper trade recently, buying has been heavy. It is estimated that total sales last week amounted to 200,000,000 pounds. The market is believed to be pretty well cleaned up, and it is thought that producers will enter the New Year under exceptionally favorable conditions.

MANITOBA MINERAL PRODUCTION

IT is estimated that the mineral production of the province of Manitoba for this year will exceed $2,500,000, this being based on the production for 1914 which was $2,428,908, and which in turn was a $200,000 increase over the 1913 mineral production.

The opening of the country in northern Manitoba by the Hudson Bay Railway will, it is expected, materially increase the mining development of the province, as there are believed to be rich gold deposits in the northern part of the province, that section of Manitoba having more mineral possibility of all kinds than the older settled districts.

Coal mining in Manitoba has not been carried on to any large extent, though there are known to be coal areas in the province of considerable worth. However, Manitoba coal has been in use in Winnipeg for some years, and the two and a half million mineral output for this year will be largely made up of coal.

Surveyors believe that there may be discovered silver deposits in Northern Manitoba which will in time prove to be valuable. The country in Northern Manitoba is not unlike the country in Northern Ontario and is similar in many respects to the Cobalt country. Gold in small quantities has been found in the sands surrounding the lakes in the northern part of the province.

Although the mining industry of Manitoba is the least developed of all Manitoba industries, the mines will have produced in three years including 1915, minerals to the value of $7,130,000. There has been a continual increase since 1912, but the development of the next year or two is expected to be very much larger in scale than heretofore.

PANAMA CANAL RE-OPENING OUTLOOK

THE U.S. War Department, Washington, D.C., have been advised by Major-General Goethals, governor of the canal zone, that he is still unable to make any prediction as to when the slides in the Gaillard Cut will be sufficiently removed to allow the world's shipping to pass through the Panama Canal. Several small vessels have been allowed to pass through, but these drew fifteen and one-half feet of water and less. The depth of water in the locks and in the channel of the canal is to be forty feet, when the slides are removed.

The fact that General Goethals is not able to say when the canal will be ready for use by larger vessels and commerce generally was announced by the Washington office of the Canal on December 21, after messages had been sent to General Goethals seeking the facts. When his reply was received, this announcement was issued:

"There have been several reports recently in the newspapers regarding the passage of vessels through the Panama Canal. A cablegram asking for information has been sent to the Isthmus and a reply has been received from which it would seem that a temporary opportunity to pass small craft drawing 15½ feet or less was taken advantage of, and certain vessels which had been held since the canal closed were allowed to pass the slide. If a similar opportunity offers a few additional vessels of greater draught, which have also been here since the closure of the canal, will probably be passed through, but the governor warns that conditions are very unstable, and it is impossible to estimate in advance what the probable available channel will be at any succeeding date."

Fort William, Ont.—From January 1 to November 30, 1915, the building permits issued and their total value, totalled 105 and $639,430 respectively.

1915 OUTPUT OF THE NOVA SCOTIA STEEL & COAL CO.

THE Nova Scotia Steel & Coal Company is believed to be the only concern in Canada which is producing munitions of war in their entirety. With the exception of the copper-driving band, all essential parts of shells from 15-pounders to 9.2-in. projectiles are made from raw material—iron ore, coke, and coal—recovered by the company on its various properties.

The output for the past year has not materially increased in point of tonnage, but has been enhanced considerably in value, due to the change in nature of most of the product. Pig iron, amounting to 72,803 short tons, was produced, while the tonnage of steel ingots made amounted to 97,000 short tons. Of the steel output, 60 per cent. was manufactured into munitions in the company's shops, 15 per cent. was exported, and 25 per cent. was sold for home consumption.

The success attained at the beginning of the year in the manufacture of forgings for 15-pdr. and 18-pdr. shrapnel shells induced the management to proceed with the manufacture of larger sizes, until at the present moment all sizes of shells up to 6 in. are being produced, and additional plant for the production of shells up to 9.2 in. dia. is being installed as quickly as possible.

These large shells, like the small ones, are manufactured complete, ready for export, and undertaking of this work has given employment to a greatly increased number of men.

The Eastern Car Co., a subsidiary concern, has been executing contracts for the Russian Government, including 2,000 box cars of special design and construction, having a capacity of 40 tons. At the beginning of this month 1,375 cars had been shipped to Vladivostock, and the balance was expected to be despatched before the end of the year.

A comparatively small amount of business was done in ore shipping during the past year, and that went entirely to the United Kingdom. The coal output has been much less than in recent years, due to shortage of labor caused by the enlistment of skilled miners, though even if the output had been up to the average of recent years, the abnormal cost of shipment by boat would have prevented it being shipped to the St. Lawrence at a profit.

Prospects for 1916 indicate that the iron and steel department will be fully employed, enough munition work having been booked to absorb the output of furnaces, mills and forges. A gratifying feature of the present activity is the number of men engaged. This is larger than at any previous time in the company's history, while the wages paid are also higher than ever before.

COKE AND COAL.

Solvay Foundry Coke	$5.75
Connellsville Foundry Coke	4.85-5.15
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

IRON PIPE FITTINGS.

Canadian malleable, 40 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 75; malleable, lipped unions, 65.

MISCELLANEOUS.

Putty, 100 lb. drums	$ 2.70
Red dry lead, 100-lb. kegs, per cwt.	9.67
Glue, French medal, per lb.	0.18
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.18
Benzine, single bbls., per gal.	0.18
Pure turpentine, single bbls.	0.66
Linseed oil, raw, single bbls.	0.73
Linseed oil, boiled, sinble bbls.	0.76
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Lead wool, per lb.	0.09
Pure Manila rope	0.16
Transmission rope, Manila	0.19½
Drilling cables, Manila	0.17½
Lard oil, per gal.	0.60

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto 40%

PROOF COIL CHAIN.

¼ inch	$8.00
5-16 inch	5.35
⅜ inch	4.60
7-16 inch	4.30
½ inch	4.05
9-16 inch	4.05
⅝ inch	3.90
¾ inch	3.85
⅞ inch	3.65
1 inch	3.45

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	60
Carbon over 1½ in.	25
High Speed	40
Blacksmith	60
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Centre	25
Pipe Reamers	80

Discounts off standard list.

COLD DRAWN STEEL SHAFTING.

At mill	40 to 45%
At warehouse	40%

Discounts off new list. Warehouse price at Montreal and Toronto.

TAPES.

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3.50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$3 00	$3 00
Canada plates, dull, 52 sheets	3 10	3 50
Canada plates, all bright	4 25	4 50
Apollo brand, 10¾ oz. galvanized)	6 40	6 40
Queen's Head, 28 B.W.G.	6 50	6 50
Fleur-de-Lis, 28 B.W.G.	6 30	6 30
Gorbal's Best, No. 28	6 50	6 50
Viking metal, No. 28	6 00	6 00
Colborne Crown, No. 28	6 30	6 30

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$10 00	.....
1¼ in.	10 00	.....
1½ in.	10 00	.....
1¾ in.	10 00	.....
2 in.	10 50	9 20
2¼ in.	12 10	.....
2½ in.	13 05	12 10
3 in.	15 75	12 70
3¼ in.	.....	13 90
3½ in.	20 00	15 00
4 in.	25 50	18 90

Prices per 100 feet, Montreal and Toronto.

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50 & 10%
Standard	60%
Cut leather lacing, No. 1	$1.25
Leather in sides	1.00

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	$9.00
¼ in.	6.25
5-16 in.	4.65
⅜ in.	4.00
7-16 in.	4.00
½ in.	4.00

Prices per 100 lbs.

WASTE.

WHITE.	Cents per lb.
XXX Extra	0 10¼
X Grand	0 09¾
XLCR	0 09¼
X Empire	0 08½
X Press	0 07¾
COLORED.	
Lion	0 07⅛
Standard	0 06⅜
Popular	0 05¾
Keen	0 05¼
WOOL PACKING.	
Arrow	0 16
Axle	0 11
Anvil	0 08
Anchor	0 07
WASHED WIPERS.	
Select White	0 09
Mixed Colored	0 06¼
Dark Colored	0 05¼

This list subject to trade discount for quantity.

BELTING RUBBER.

Standard	50%
Best grades	30%

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., June 28, 1915. — It would appear that the tendency of the metal market is to become stronger and steadier. It is true that there have not been any sudden increases in prices; the increments being mostly fractional, but of a continuous order. The continued demand for certain alloys of the different metals entering into the manufacture of shells has been the cause of recent disturbances on account of stock shortages.

Up to the present there are numerous manufacturers who are just beginning to adapt their plants for the making of shells and there are sure to be others who will come in later. In fact, it appears that this business is only in its infancy. These considerations may carry some weight with the holders of metal stocks, and cause them to anticipate even higher prices. As far as the steel and iron trade is concerned, although the demand is light, there does not seem to be any apparent weakening in quotations.

Twisted Reinforcing Bars.

The extension to the Harbor Commissioners' elevator No. 2 will take care of an enormous quantity; tenders on this item being now under consideration. There is also a large reinforced concrete dam to be built on the upper stretches of the St. Maurice river above La Tuque,

P. Q., this dam to be used for storage purposes. The Commission of Streams for the Province of Quebec, it is said, have the plans for this work well in hand, and several thousand tons of reinforced bars will be required. No tenders have as yet been called.

Among the price movements of the past week, that of aluminum is most noticeable. The amount of metal offeirng at the price quoted is small. After the recent flurry in lead, the price has now steadied to 7½c, and will likely remain there for some time. English lead, of course, is higher, but is being kept for home consumption. Galvanized sheets remain the same as last week with very few importations.

Toronto, Ont., June 29, 1915.—Comparatively few orders for shells have been given out during the past two or three weeks; the reason for this may possibly be found in the statement recently issued by the Shell Committee. It appears that only fixed ammunition is required by the British Government which means that all shells made in Canada will have to be complete before being shipped and not just the cases as formerly. More plants will now have to be equipped, or existing ones extended for making cartridge cases and fuse plugs; the explosive and firing charge will also have to be added before shipment. It seems highly probable that under the new conditions much larger orders for shells will be distributed among Canadian plants. With the addition of French and Russian orders, the outlook is distinctly favorable in this industry.

The situation is improving as regards foreign business and interesting developments are expected. The Canada Car & Foundry Co. is negotiating with the French and Russian Governments for large orders for railroad cars, while the same company has received an order for 600 freight cars for the Intercolonial Railway. The Canadian Locomotive Co. will build 15 locomotives also for the Intercolonial Railway. Other orders have already been placed with Canadian concerns for rolling stock, one of the latest being for 1,300 freight cars for the Northern Railway of France, to be built by the National Steel Car Co. of Hamilton, Ont. Taken in the aggregate, these orders represent a large amount of money and will also help an industry which has been dull for many months.

There are good prospects of further orders for army supplies and equipment, other than munitions, coming to this country. It is understood that Sir Thomas Shaughnessy has made arrangements with the British Government for the purchasing department of the C.P.R. to be used as a medium for obtaining the necessary equipment, etc.

Steel Market.

The general situation in the steel market is unchanged. The chief interest lies in the demand for rounds for shells; the tonnage is steadily increasing and will continue to do so as further orders are expected for Russian and French shells in addition to the requirements of the British Government. The orders for cars and locomotives referred to above will help the steel trade and there are possibilities of developments in export business in other steel products.

Domestic trade is not showing much improvement as industrial conditions are quiet, apart from the orders induced by the war. The building trade is still quiet, but municipalities are showing a little more activity as regards their requirements for cast iron and steel pipe. The tonnage will be much below last year on account of the difficulty being experienced in financing new works. Prices on steel products generally are firm but unchanged. There has been no further change in the quotations on galvanized sheets. The situation in the galvanizing trade is no better, notwithstanding the further weakness in the spelter market last week. The price of spelter is too high for it to be utilized in the manufacture of galvanized sheets and some makers still refrain from quoting.

Higher prices for galvanized pipe are announced. This advance has been caused by the high cost and scarcity of spelter, present prices being almost prohibitive for galvanizing. New basing discounts are given in the selected market quotations. There is no change in black wrought iron pipe.

The steel market in the States has been considerably stronger during the past week and prices are holding very firm. The export market has been very active with orders for rails, cars, locomotives and munitions. Indications point to increasing export business and an improvement in the domestic demand.

COMING CONVENTIONS.

American Foundrymen's Association, Atlantic City, N.J.—Sept. 27-Oct. 1.

Foundry and Machine Exhibition Co., Atlantic City, N.J.—Sept. 25-Oct. 2.

CANADIAN GOVERNMENT PURCHASING COMMISSION.

The following gentlemen constitute the Commission appointed to make all purchases under the Dominion $100,000,000 war appropriation:—George Gault, Winnipeg; Henry Laporte, Montreal; A. E. Kemp, Toronto. Thomas Hilliard is secretary, and the commission headquarters are at Ottawa.

Pig Iron.

The market is featureless and little business is passing. Prices are unchanged.

Scrap Metals.

Prices on copper and brass scrap continue very firm and good business is reported. Scrap lead and zinc have a weaker tendency, but are unchanged. There is little interest being shown in iron and steel scrap, and the market is dull and stationary. Prices are given in the selected market quotations.

Machine Tools.

Inquiries for machine tools have fallen off to some extent due, it is said, to the fewness of orders for shells lately. Dealers, however, are exceptionally busy filling orders already placed and a resumption of inquiries is expected any time. Prices of machine tools continue in an upward direction and some makers have effected further advances ranging from 10 to 15 per cent. Many machinery manufacturers are sold months ahead and consequently deliveries are away behind. When the orders for 4.5 shells are more numerous, greater activity in the trade is anticipated. The principal demand at the present time is for machines and tooling fixtures for making 18-pdr. high-explosive shells. Special machines are being developed for performing some of the operations.

Supplies.

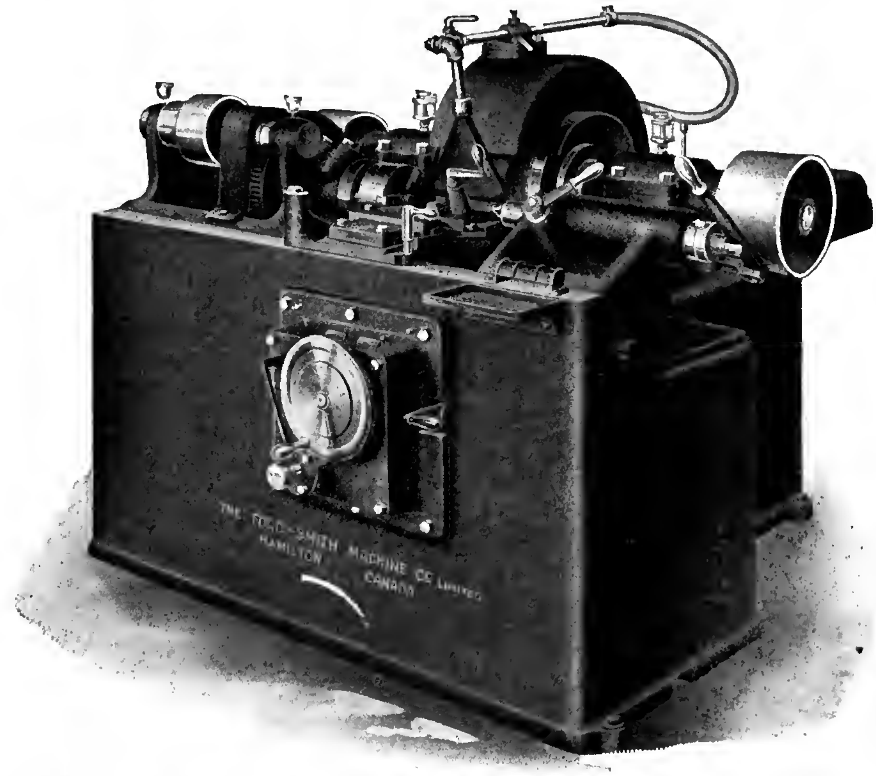
The activity in the supply business continues and dealers report satisfactory orders, principally in connection with shell plants; waste, twist drills, tool steel, chucks, belting, cutting compounds, etc., all being in good demand. Linseed oil has declined 5c and is now quoted at 73c per gallon for raw oil. Turpentine is firmer and has advanced 1c, being now quoted at 66c per gallon. Rope prices are very firm and may advance; red lead also may go higher.

Metals.

The markets generally are firm but there are no important price changes to note except spelter, which has recovered and is again on the up-grade. The spelter market is very unsettled and it is almost impossible to size up the situation. Tin is dull but the market is very firm and higher. Copper is unchanged and quiet. Lead is steady after the reaction reported last week. Antimony and aluminum are firm, the latter having advanced.

Tin.—The market is firm but dull, and

The Ford-Smith One Operation Shrapnel Shell Grinder



A Powerful Extra Heavy Grinder for finishing Shrapnel and General "Wide Wheel" Grinding.

This machine, using an Abrasive Wheel 20" dia. x $8\frac{1}{4}$" face, grinds both body of shell and nose as quickly as the lighter type general purpose precision grinders can grind the body alone.

Depending on the amount of stock left for finishing, we grind from fifteen to sixty-five shells without re-trueing the wheel.

POWER—Two 6" Belts drive the Emery Wheel Spindle, one 4" Belt with one to four gearing drives the shell.
RIGIDITY—Machine weighs 7,000 pounds of carefully distributed metal with an absolute absence of vibration.
CONTROL—Necessary levers, etc., all in front, the wheel trueing device swings into position when required.
ABRASIVE WHEEL is held solidly between two $3\frac{3}{4}$" bearings, on Safety Flanges, and six to 10,000 shells can be ground before renewing.

We have thirty-five of these machines in operation, doing from one hundred and forty to two hundred shells per ten hours, according to amount of stock left on the shell.

It will pay you to investigate this machine in comparison with your lathe work, or other grinder performances.

GET IN TOUCH WITH US TO-DAY

The Ford-Smith Machine Co., Limited

HAMILTON, CANADA

buyers are showing little interest. There is hardly any spot demand and very little inquiry for futures. The local market for tin has advanced 1c, and is quoted at 46c per pound.

Copper.—The market is higher in London, but unchanged in New York. There is no change in the situation as far as the big producers are concerned, as they are pretty well sold up for two months ahead. Quotations are unchanged at 21½c per pound.

Spelter.—The market has recovered and is very strong. This recovery was started by important interests advancing their prices. The advance was apparently quite unexpected in the trade, and buyers do not know what is at the back of this movement. The market is very unsettled and it is difficult to say what will develop. Spelter has advanced 2c and is nominal at 28c per pound.

Lead.—The market is firm and the Trust continues to hold their quotations at 5.75c. New York. There is a better tone in the market, but business is quiet. Local quotations are unchanged at 7½c per pound.

Antimony.—The market is quiet but very firm. The situation is unchanged, and the consumption continues to increase. Quotations are nominal at 40c per pound.

Aluminum.—A shortage of this metal has developed and the market is very strong. Local quotations have advanced 5c and are nominal at 35c per pound.

St. John, N.B., June 26.—A new industrial plant has been established in St. John—the St. John Milling Co.,—which is now operating its factory on west side, turning out fifty barrels of flour daily. For several months past mill-wrights, engineers, and other workmen have been busily engaged in installing and arranging new machinery of improved type in the mill, and the work has at last been completed.

While in St. John this week, Hon. J. D. Hazen, Minister of Marine and Fisheries, and late Acting Minister of Militia, sounded the trumpet call to Canadian manufacturers to help in the production of shells and other war munitions. In this city, at least two foundries are occupied in their manufacture, while other concerns are busy with other war orders. There must, however, be many plants which with a little renovating and alteration, could be adapted to the manufacture of shells, and Hon. Mr. Hazen said he would like to see them aid in this connection.

Lieut. Donald Fisher, of the Royal Canadian Dragoons, has been wounded in action in France. His friends will be pleased to learn that his injuries are reported not to be serious. Lieut. Fisher is a son of W. Shives Fisher, of Emerson & Fisher, proprietors of the Enterprise Foundry, at Sackville, N.B. He left here with the first Canadian contingest.

ONTARIO HYDRO-ELECTRIC SYSTEM.

THE total revenue from the 84 municipalities, railways and users of the Niagara Circuit of the Hydro-Electric System for the six months ending May 1, is $710,324.95, according to the official report made to the Commission by the chairman, Sir Adam Beck. After providing some $303,000 for the cost of power, $49,000 for maintenance, $155,000 for interest, $30,000 for operation, $156,000 for engineering and construction, the sum of $69,908.37 has been applied to the sinking fund, and $50,210.35 to the depreciation and reserve account. The average horse-power consumed per day during the half-year has been 75,281.

An order was made upon the Ontario Power Company for an additional 100,000 horse-power, and at present 90,000 horse-power is being taken. The present call is accordingly for the last 10,000 horse-power available under the existing contract, and on the recommendation of Sir Adam Beck the Commission decided to investigate and report to the Government, probably within two weeks, various schemes under which the supply of power in this part of the province may be largely increased.

In addition to the Niagara supply, the Commission is now securing between 4,000 and 5,000 horse-power from the Ottawa development, 2,000 from the Port Arthur, 2,000 from Big Shute, 2,000 from Wasdell Falls, and plans to serve the Grey and Bruce district from Eugene Falls.

In St. Thomas and Galt, where the greatest reductions have been made, the surpluses, after paying debenture debts, overdrafts and other charges are reported as $4,072.74 and $2,209.45, respectively. In the city of Toronto, for the quarter ending March 31, after paying all fixed charges including sinking fund the surplus is $31,715.91.

ALLIES PURCHASING AGENTS.

The Trade and Commerce Department, Ottawa, has published the following list of purchasing agents for military purposes for the allied Governments:—

International Purchasing Commission, India House, Kingsway, London, Eng.

British.—Col. A. G. Barton and F. W. Stobart, Ritz Carlton Hotel, Montreal.

French.—Hudson Bay Co., 56 McGill Street, Montreal; Captain Lafoulloux, Hotel Brevort, New York; Direction de l'Intendance Ministere de la Gnerre, Bordeaux, France; M. De la Chaume, 28 Broadway, Westminister, London.

Russian.—Messrs. S. Ruperti and Aieksieff, care Military Attache, Russian Embassy, Washington, D.C.

DEMAND FOR ANTIMONY.

IN each British 18-pounder shrapnel shell there is approximately one pound of antimony. The shrapnel bullet is composed of 87½ per cent. lead and 12½ per cent. antimony, and the total weight of the bullets in the shell is close to eight pounds.

The enormous production of shrapnel, including shells now in course of manufacture, already has reached a total that is far in excess of the U. S. imports of antimony for last year. Imports then were in excess of 14,000,000 pounds. However, there were produced close to 25,000,000 pounds of antimonial lead in that country in 1914. The antimony content was about 2,500,000 pounds.

"The situation in respect of supplies is less acute than early in May," says the Wall Street Journal, "when the tension in affairs between Japan and China threatened to shut off the only present foreign source of supply for the United States. The apparently more friendly relations between those two countries has reassured the American manufacturers, especially the type makers—the commercially big users of antimony.

SHELL COMMITTEE STATEMENT REGARDING SHELL ORDERS.

THE Canadian Shell Committee, of which General Alexander Bertram is chairman, has prepared a statement for the press in explanation of the remarks of Lord Curzon in the British House of Lords on June 23. Lord Curzon is reported to have said that the British Government desired to obtain all possible material from the Dominions but Canadian makers did not make shells complete, and had to go to the United States for component parts. He added that "delivery from Canada had been exceptionally bad."

It is understood that the "bad delivery" refers only to shells ready for use. Hitherto, to complete the shell, certain importations have had to be made from the United States, but steps were taken some time ago to overcome this difficulty, and it is hoped that in a very few weeks it will be completely removed.

The statement of the Shell Committee is as follows:—

"The attention of the Shell Committee has been called to observations attributed to Lord Curzon in the House of Lords recently. The undertaking of the Shell Committee for deliveries of empty shells has been thoroughly fulfilled and empty shells to a larger amount than those delivered could be forwarded immediately if desired by the War Office.

"The British Government, however, have notified the Shell Committee that future deliveries must be of fixed ammunition and that the further production of empty shells is no longer required. To convert the empty shell into fixed ammunition involves the purchase of machinery and the establishment of the necessary organization by industrial companies of Canada, who were prepared to undertake the work.

"The success which has attended the efforts for that purpose is regarded by the Shell Committee as thoroughly satisfactory, but it can readily be understood that the capacity to produce empty shells in Canada far exceeds the capacity of the organization only recently established to convert empty shells into fixed ammunition.

"The 650,000 shells which up to a couple of weeks ago had been shipped from Canada were empty shells. Since then complete shells have been going forward in small quantities and it is now assured that hereafter they will be shipped in increasing numbers.

"For obvious reasons, the official reply to criticisms has been hitherto that Canada was filling all the orders it had received, but Lord Curzon's remark has led to the fuller explanation of now. For completed shells Canada will get all the orders it wants, and it is to the turning out of completed shells that all the energies of the Shell Committee are now bent."

The expression "empty shells" refers of course to shells without fuses and in which the explosive is lacking.

Herbert M. Ewan has resigned from the position of sales manager of the Canadian Steel Foundries, Ltd., Montreal, and will join the firm of Taylor & Arnold, Ltd., dealers in railway supplies and locomotive specialties, Montreal and Winnipeg, as vice-president; the change to take effect on July 1. Mr. Ewan who was born in Montreal, has been connected with the Montreal Steel Works and Canadian Steel Foundries for over eleven years, latterly in the capacity of sales manager. He has had considerable experience in England and the United States as well as in Canada of the steel and railway supply business.

A. R. McPherson, manager of the Windsor Foundry & Machine Co., is recovering from his recent serious illness.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Goderich, Ont.—The Paget Grain Door Co. will make motor trucks.

Pictou, N.S.—A new smoke stack will be erected at the electric light plant here.

Lachine, Que.—The Lachine Gas Mfg. Co. will make an extension to their plant.

Milton, Ont.—Machinery for making shells is being installed in the local screw factory.

New Glasgow, N.S.—A fire on June 13 damaged F. W. Cummings' machine shop to the extent of $5,000.

Lindsay, Ont.—Arrangements are being made at John McCrae's foundry to install machinery for making shells.

Welland, Ont.—The Standard Construction Co. are the contractors for the addition to the plant of the Canadian Billings & Spencer Co.

Toronto, Ont.—Dominion Wheel and Foundry Co. will build a one-storey frame and galvanized addition to their foundry, 131 Eastern Avenue, to cost $5,000.

Toronto, Ont.—The Commissioner of Works, R. C. Harris, has recommended the purchase of two electrically-driven pumps for the High Level Pumping Station, with a capacity of 7,500,000 gallons each per day.

Petrolia, Ont.—A by-law will be voted on by the ratepayers on July 14 to authorize the expenditure of $35,000 on the construction of a new electrical distribution plant or the purchase of the plant of the Petrolia Utilities Co.

Toronto, Ont.—The Steel & Radiation Co. have applied for a permit to erect a one-storey brick addition to their factory at 19 to 21 Fraser Avenue, at a cost of $2,500. The building is to be used for the manufacture of ammunition.

Farnham, Que.—A meeting of the Board of Trade was held on June 22. The manufacture of munitions of war was discussed and a committee was appointed to go fully into the matter, and endeavor to establish a plant for the purpose.

Montreal, Que.—Dominion Bridge Co., which has developed one of the largest shell-making organizations in Canada, is now constructing an extension to its works at Dominion. The new plant, which is designed for work on high explosive shells, will cover about an acre of ground.

Electrical

Winnipeg, Man.—An extension will be made to the King Street sub-station.

Sarnia, Ont.—Hydro-Electric system may be adopted here. The commission's engineers have valued the Sarnia Gas & Electric Co. plant at $155,000.

Exeter, Ont.—A by-law to provide $20,000 for the installation of a Hydro-Electric system is being considered by the Town Council. Clerk, J. Senior.

Ailsa Craig, Ont.—By a vote of 132 to 4, the ratepayers of Ailsa Craig carried a hydro-electric enabling by-law last Monday. The installation of the system will cost $7,000.

Leamington, Ont.—The Town Council are considering the question of installing a hydro-electric system. The Commission's engineers have been requested to submit an estimate as to the cost.

Kincardine, Ont.—The Water and Electric Light Commission has decided to purchase 44 nitrogen electric lamps and brackets to replace the 18 arc lights on the streets, which have not given satisfaction.

Toronto, Ont.—The Provincial Hydro-Electric Commission has awarded contracts for the construction of stations at Owen Sound, Chatsworth, Dutton, Thamesville, Ridgetown, Blenheim and Bothwell, and authority is given to construct lines to those stations.

Contracts Awarded

Woodstock, Ont.—The George H. King Co. has been awarded a contract for 25,000 ammunition boxes at $24,000.

Dorchester, Ont.—Richard Waltham, of Kerwood, has been awarded the contract for the masonry of Elgin bridge, at $2,900, whilst the steel work goes to the Dominion Bridge Co. of Toronto at $3,685.

Hespeler, Ont.—A contract has been let to the Des Moines Steel Co., of Pittsburg, Pa., for a 100,000 gallon standpipe. Contracts have not yet been awarded for pumping machinery. Bowman & Connor of Berlin, Ont., are the engineers.

Sidney, N.S.—Reid McManus, of Memramcook, has been awarded the contract for the construetion of a spur line connecting the main line of the Intercolonial Railway with the new pulp mill erected by the Bathurst Lumber Co. The contract price is $61,000.

Owen Sound, Ont.—Messrs. Grier & Lethbridge, contractors, have been advised by the Hydro-Electric Commission that their tender for the Hydro-Electric transformer station here has been accepted. The contractors will commence the work of clearing the ground and the erection of the building at once.

Selkirk, Man.—The Department of Public Works, Winnipeg, have let the contract for the construction of an elevated water tank at the Hospital for the Insane, to the Chicago Bridge & Iron Works, Bridgeburg, Ont., at $7,300, and for the installation of a steam pump to the General Supply Co., of Canada, Ltd., Winnipeg, at $1,050.

Tenders

Toronto, Ont.—Tenders will be received up to Tuesday, July 6, 1915, for the supply of: 55—A—Two portable crossovers, right and left-hand turnouts, and No. 60 rail: 64—One steam pump, complete, for hydraulic operation of gate valves, high level pumping station; 65—Air compressor, with motor, Danforth avenue car barns. Tenders must be addressed to the chairman, Board of Control, City Hall. Specifications and forms of tender may be obtained at the Works Department, City Hall.

Ottawa, Ont.—Tenders will be received until Monday, July 12, 1915, for the construction of the superstructure for a bridge, consisting of four spans, over the Quinze River at North Timiskaming, Pontiac County, Que. Plans and forms of contract can be seen and and specification and forms of tender obtained at the Department of Public Works, Ottawa, and at the offices of the District Engineers, Shaughnessy Building, Montreal, P.Q.; Confederation Life Building, Toronto, Ont.

Trade Gossip

London, Ont.—Sir Adam Beck announced on June 24 that the official opening of the electrified London and Port Stanley Railway would take place on July 22.

M. Beatty & Sons, Welland, Ont., have obtained an order from the War Purchasing Commission for a large number of hoisting engines, centrifugal pumps and clamshell buckets.

Hamilton, Ont.—It is reported that the National Steel Car Co., has secured an order for 1,300 railway freight cars from the French Government. The contract is estimated at $1,250,000.

Sidney, N.S.—It is reported that the Aetna Explosive Co., of New York, will establish a plant here. A. J. Moxham is connected with the company which has been granted a Dominion charter.

Kingston, Ont.—The Canadian Locomotive Company has received a rush order from the Dominion Government for fifteen heavy engines to be used on the Intercolonial Railway. Work on them has already begun.

Montreal, Que.—The Montreal Ammunition Co., a subsidiary of the Dominion Bridge Co., which has rented the plant of the National Bridge Co., will be ready to start manufacturing operations on war munitions in about a month. The plant and equipment are now being installed.

Ottawa, Ont.—It is reported that the dry dock at Prince Rupert, B.C., will be sufficiently advanced to enable shipbuilding to start by next August. The last pontoon was launched recently and the upper works are being proceeded with. The dry dock when finished will have cost some $3,000,000.

Vancouver, B.C.—As a result of another meeting of the creditors of the Heaps Engineering Co. held here recently, an agreement has been arrived at which, if satisfactory to the bondholders, will remove all obstacles in the way of utilizing this modern plant for the manufacture of munitions of war.

Walpole Rubber Co.—Letters patent have been issued to the Walpole Rubber Co. of Canada, Ltd. This refers to the reorganization of the concern at Granby following a recent change of ownership, in which Canadian Consolidated Rubber was directly concerned. Little information has been made public as to detail of plans regarding the operation of the subsidiary.

Hamilton, Ont.—The National Steel Car Co. has secured another big war order. Basil Magor, general manager, has been in close touch with the French Government for some months, and on Saturday he stated that articles were practically signed for the delivery of 1,300 railway freight cars for use on the Nord Railway. The contract is estimated at $1,250,000.

Training the Unskilled in Shell-making.—Men unskilled in lathe operation, but who are desirous of taking a hand in the manufacture of shells in Sheffield, England, are being given two weeks' thorough training in this feature at the University Applied Science Department, after which they pass to the armament works to do what they can there.

M. Beatty & Sons, Welland, Ont., were successful in getting an order from the War Purchasing Commission for five carloads of material-handling machinery, made up of hoisting engines, derrick irons, turntables, centrifugal pumps and clamshell buckets, all of which will be used by the Overseas Construction Corps in Europe. The order was received on Saturday, May 29, and the goods went forward knocked down and packed for ocean shipment on June 1.

Ottawa, Ont.—An agreement has been reached between Hon. Frank Cochrane and the Grand Trunk Pacific Railway for the leasing of the Lake Superior section of the N. T. R., which runs from Graham, Ont., to Fort William, Ont. Pending its signing, there will be no official announcement, but it is understood that the lease is in the neighborhood of $600,000 a year, which is about 4½ per cent. of the original cost of the line.

Canadian Electrical Association. — At a meeting of the member companies of the Canadian Electrical Association, held at Ottawa last Saturday, the following officers were elected: President, Lieut.-Col. D. R. Street, Ottawa Electric Co.; first vice-president, D. H. McDougall, Toronto Electric Light Co.; second vice-president, W. S. Roberts, Electric Power Co., Toronto; third vice-president, W. G. Matthews, Quebec Railway, Light and Power Co.

Stratford Lodge, C.A.S.E.—At the regular meeting of Stratford Lodge, No. 31, C. A. S. E., the following officers were elected for the current term:—Past president, Alex. Scrimgeour; president, J. Schafer; vice-president, J. Hickman; secretary, J. A. Robertson; recording secretary, G. L. Frame; treasurer, George Hird; conductor, J. F. Smith; doorkeeper, Maxwell Mongraw. Delegates to convention at Hamilton on July 20, 21 and 22, Alex. Scrimgeour and Peter Steinman, Tavistock; alternates, Geo. L. Frame and J. F. Smith.

Russian Car Orders.—A first visit was paid to Montreal on June 23, by Maximilian Groten, chief mechanical engineer for the Russian Imperial Railways, attached to the Russian Ministry of Ways and Communications, Petrograd. Mr. Groten came to Montreal to look over the car plants here in connection with large orders placed by the Imperial Russian Government for steel frame box cars. The Russian Government has ordered 2,000 of these cars from the Eastern Car Company of New Glasgow, N.S., and 18,000 similar cars from a number of firms in the United States. Mr. Groten had visited the works of the Eastern Car Co. at New Glasgow, and also the plant of the Nova Scotia Steel & Coal Co., previous to coming to Montreal.

Municipal

Oshawa, Ont.—On July 10, a by-law will be voted on to raise $8,000 to bonus a firm proposing to make shells.

Canora, Sask.—A by-law will be voted on by the ratepayers on July 9, to raise $17,700, for completing the waterworks system.

Preston, Ont.—A by-law to loan the Hurlbut Shoe Co. $25,000 was carried here on June 21 by a majority of 126 over the two-thirds vote necessary.

Unionville, Ont.—The Village Council are having plans for a waterworks system prepared by James, London & Hertzburg, engineers, 79 Adelaide Street E., Toronto.

Mimico, Ont.—The Council has decided to secure water from New Toronto. It is the intention of the Council to proceed with the installation of the water mains.

Watrous, Sask.—C. McManus & Co. have been instructed to proceed with extensions to the water distributing system. Some 8-in. cast iron pipe will be required.

Woodstock, Ont.—The Town Council are considering making extensions to the waterworks system. F. A. Barbour, of Boston, Mass., has been engaged as consulting engineer.

Fredericton, N.S.—The City Council contemplate installing a new fire alarm system, which is estimated to cost $1,200. T. S. Wilkinson is chairman of the Fire Committee.

Windsor, Ont.—The City Council are in the market for a quantity of cast iron pipe and specials, geared valves, fire hydrants, pig lead and valve boxes. W. A. Hanrahan is secretary of the Water Commission.

Bassano, Alta.—The by-laws authorizing the expenditure of $10,000 for completing the town's gas-well and piping the gas was carried. The by-law will likely receive its third reading at the next council meeting.

Lindsay, Ont.—A by-law to authorize construction of certain extensions of water mains has been given its several readings, as well as a by-law providing $6,000 by way of debentures to provide for cost of construction of same. All the extensions outlined in by-law have been constructed.

Chatham, Ont.—As soon as the necessary arrangements have been made, a by-law will probably be submitted to Chatham ratepayers providing for the raising of about $18,500, the amount that it has been proposed for the city to give towards the purchasing of the site of the Dominion Sugar Co. for its $1,000,000 sugar plant to be erected just outside the city.

Personal

Guelph, Ont.—Applications are being received by T. S. Moore, city clerk, for a city engineer.

E. J. Holland, who recently resigned his position as city engineer of Guelph, Ont., will engage in private work in Western Ontario.

Leslie Brinkman, of St. Thomas, Ont., has been appointed assistant to the chief engineer of public works, with headquarters at Fort William, Ont.

W. A. Black, vice-president and managing director of the Ogilvie Flour Company, is making an extended tour of the Canadian West to get into direct touch with the crop and milling conditions.

D. R. Hanna has retired from the firm of M. A. Hanna & Co., Cleveland, Ohio, sales agents for "Victoria" pig iron produced at Port Colborne, Ont. Mr. Hanna was admitted to the firm in 1891.

A. W. Mace has resigned his position with the Factory Products, Ltd., Toronto, Ont., temporarily, to give assistance in the war munitions department of the United States Steel Products Co., New York City.

Frank F. Barber has resigned his position as manager of the machine tool department of the Canadian Fairbanks-Morse Co., Toronto, and will be connected with the machine tool department of the A. R. Williams Machinery Co., Toronto, Ont.

Douglas J. Peake, until recently with the United States Cast Iron Pipe & Foundry Co., Burlington, N.J., has been

appointed foundry engineer and assistant to the general superintendent of foundries of the Canada Iron Corporation. Two years ago, Mr. Peake was connected with the Three Rivers, Que., plant of the latter concern.

Catalogues

Generating Sets.—Enberg's Electric and Mechanical Works, St. Joseph, Mich., are distributing bulletin No. 101, describing their direct-connected dynamos and engines, made in sizes ranging from 1 to 50 k.w. The bulletin contains a comprehensive description covering the design of both engine and dynamo. It is fully illustrated and tables are included giving the weights and principal dimensions.

Slotting Machines.—Catalogue No. 49 recently issued by the Newton Machine Tools Works, Inc., Philadelphia, Pa., deals with the complete line of Newton standard and special slotting machines. The catalogue also contains a number of illustrations showing an interesting line of milling machines, rotary planers and cold metal saws, etc. The illustrations are very clear and give a good general idea of their construction. They are accompanied by tables giving the principal dimensions covering the various sizes.

Motor Trucks—The "Knox" tractor is described fully in an attractive catalogue recently issued by the Knox Motors Associates, Springfield, Mass., who are the distributors. The big feature of the Knox tractor, as claimed in the catalogue is that it will haul any kind of load in any type of trailer. Among the illustrations are views showing several types of trailer while others show the tractor and engine. A specification is included covering the model 35 tractor.

Motor Generator Sets made by the Canadian General Electric Co., Toronto, are the subject of a 28-page bulletin No. 42552, recently issued. The bulletin contains a lot of useful information on various types of motor generator sets and their field of application. The construction of these machines and matters relating to their operation are dealt with in an exhaustive manner. An interesting feature of this bulletin is a number of half tones of motor generator sets of various types showing their wide range of application. The bulletin is exceedingly well gotten-up and the half tones are very good reproductions. Copies may be obtained by interested readers upon application.

Book Reviews

Preventing Losses in Factory Power Plants, by David Moffatt Myers 560 pages; $7\frac{1}{2}$ in. x 5 in.; 68 illustrations. Published by the Engineering Magazine Co., New York. Price $3. This is a new work, and is an addition to the Works Management Library. The book has been written expressly for the use of the owners and managers of manufacturing industries with the object of setting forth in as brief and direct a manner as possible the basic information which they require for the intelligent handling of their power plant problems. The first nine chapters cover these matters in a general way, but easily assimilated, while the remaining nine chapters deal with the subject in greater detail, and are more especially of value to the mechanical superintendent and engineer. The subjects treated successively in the initial nine chapters are as follows:—Determination of existing losses, attainable efficiency and ordinary wastes, the boiler plant, steam piping and engine plant, preventable losses in the engine plant, and the heating system. The ninth chapter dealing with the "Human Factor," the author considers to be of the greatest importance. The succeeding chapters deal with efficiency systems for boiler plants, boiler tests, combustion, surface combustion, natural gas as a boiler fuel, natural gas for the gas engine versus the steam engine, the economic combustion of waste fuels, boiler feed pumps, modern types of prime movers, while the concluding chapter is devoted to reports and their compilation. From the above it will be gathered that the book contains a great deal of useful information for those desiring to improve the efficiency of their plants. While the subject matter is not necessarily new, it has the advantage of being brought together and presented in a convenient form so that the relation of the various subjects can be studied together. By this means a more complete understanding of power plant problems is made possible. The book is printed in clear type, with diagrams and tables.

Sidney, N.S.—Mark Hurll, of Glasgow, Scotland, has been investigating the fireclay deposits in this district with a view to establishing a plant for making fire brick.

Lindsay, Ont.—A by-law submitted to the ratepayers to authorize payment of $65,000 to the Horn Brothers' Woollen Co. was carried here on June 24 by a majority of 311.

Weyburn, Sask.—E. R. Humphries, Regina manager for the Canadian Oil Companies, Ltd., was in town recently for the purpose of completing arrangements for locating a distributing station at this point.

Trade Gossip

Canadian Vickers, Ltd., Montreal, have sold a motor generator costing $5,400 to the city of Winnipeg, Man.

Heap & Partners, Canada, Ltd., Montreal, have been awarded a contract by the Ottawa city council for the supply and installation of a pump.

The Canadian Fairbanks-Morse Co., Toronto, have received a repeat order for an X-ray electric generator outfit for the Canadian Expeditionary Force.

The B. F. Sturtevant Co., of Canada, Ltd., Galt, Ont., have been awarded the contract for the heating and ventilating equipment for a new shop which the Canadian Locomotive Co. are building in Kingston, Ont.

The John Bertram & Sons Co., and its associate company, the Pratt & Whitney Co. of Canada, Ltd., announce change of Western office address to 1205 McArthur Building, Winnipeg. A. Martin is the Western representative.

Transcona, Man.—A notice has been issued to the effect that commencing today, July 1, 1915, the Dominion Government has taken over the operation of the Transcona shops, round-houses and work pertaining to this department between Winnipeg and Westfort.

Berlin, Ont.—A company has been formed with a capital of $100,000 to manufacture carburetors and vaporizers here. The patents are controlled by the Kerosene Burning Carburetor Co., of Detroit, Mich. Claude Forsyth of the John Forsyth Co., Berlin, is interested.

The Prince Rupert, B.C.—The Board of Trade published its annual report for 1914, together with general information as to the resources of the district of northern British Columbia. The report contains an interesting review of trade and commercial conditions at Prince Rupert, and indicates opportunities for industrial development.

Delay Shell Shipment.—Orders to delay shipment of any more shells for the present have been received by manufacturers, the instructions being that these should be held until further notice. While no information was given as to the reason for the order, it is felt that it is due to the shell cases being turned out more rapidly than they can be filled with explosives for shipment to England.

Dominion Steel Production.—The Dominion Steel Corporation production for the month of June, with comparisons, was as follows:

	1915, tons.	1914, tons.
Pig iron	22,552	21,111
Steel ingots	28,680	26,629
Rails	13,044	16,998
Rods	6,435	1,981
Bars	797	2,347
Wire and wire products	3,167	1,541
Coal mined	481,820	485,449

Customs Receipts Show Increase.—For the first time in a considerable period, Customs receipts for the month just closed, June, show an increase over the same period last year. This is an indication that the new war taxes are beginning to take effect. Customs receipts for June were $7,315,638.74, as compared with $7,274,763.32 in June, 1914, an increase of $40,875.42. For the three months ending June 30 the total Customs receipts were $20,907,939.88, or $772,530.66 less than during the corresponding period last year.

Halifax, N.S.—At a Board of Control meeting on June 30, the directors of the Nova Scotia Car Works, Ltd., asked the city for an additional $125,000, as further capital is declared by directors to be absolutely required to successfully carry on its business. The city originally advanced $125,000 and a portion of this loan has been paid off by instalments. The additional amount asked for will bring the company's liability to the city up to $250,000, and the amount will be secured by mortgage in same manner as previous advance.

Canadian Trade.—The possibilities of increased trade between Russia and Canada are now being seriously considered. Until a short time ago Canada did no business direct with Russia. In 1913, out of our $2,145,000 of exports to Russia no less than $2,017,000 passed through the United States. Similarly Russian products were brought to Canada in foreign ships. Now the Canadian Pacific Railway are establishing a line of steamers between Vancouver and Vladivostock, and it is expected that an increased and direct trade will be built up between the two countries.

Shell Shipping Boxes.—The Shell Committee, Stephen Building, Ottawa, have issued the following additional details in connection with the specifications for shell boxes. In reference to the screw used to secure the cover in the 4.5 shell box, we would say that you have the alternative of using No. 12 x 1¾ ins., or No. 14 x 1¾ ins., and that there is to be only one screw in each end and two in each side, suitably spaced. Further, the cleats on the cover are to be made ⅝-inch instead of ½-inch. Also, the lumber throughout the box may be dressed to an even thickness not less than ⅞-inch.

The Canadian Car & Foundry Co., Montreal, has received an order from the Railway Executive Committee of the British War Office for 1,200 four-wheel, continental type, 22-ton, steel frame box cars. The value of the order was placed at $1,200,000 by W. W. Butler, senior vice-president, who states that the cars will be manufactured at the company's local plants. Manufacturing operations will be started immediately. Mr. Butler explained that the cars were to be used in connection with military operations of the British army in northern France. The specifications of the equipment conformed in every respect to the standards of the French railways.

Canadian Car Co. Shell Contract.—It is understood that the loading of shrapnel and high explosive shells by the Canadian Car & Foundry Co. in its $83,000,000 contract with the Russian Government was not included in the original contract, but that it was arranged for later at the request of the Russian Government. Construction of the factory for assembling and loading of the shells near Lyndhurst, N.J., is not expected to be completed for about a month. No exports of shells by the Canadian Car Co. are looked for before the early part of August, although shipments of parts to assembling points by American manufacturers to whom the contract was sub-let will be well under way before then.

Large Equipment Orders.—Further equipment orders have been placed this week. The Federal Government has ordered 15 locomotives, to cost $22,000 each, from the Canadian Locomotive Co. of Kingston. An order has also been placed for 1,000 box cars for the National Transcontinental Railway. This contract has been placed among three concerns—the Canadian Car and Foundry Co., the National Steel Car Co., and the Nova Scotia Car Co. The Canadian Locomotive Co. is already working on a Russian Government order for 50 locomotives, while the Eastern Car Co. has an order for 2,000 cars also from the Russian Government. Canadian Car & Foundry Co. have a Dominion Govern-

ment order for 600 standard freight cars for the Intercolonial Railway.

Canada's Metal Production.—Last year Canada produced metal and metallic ores valued at \$58,870,000. Copper contributed 75,000,000 pounds at an average price of 13½ cents; gold, 770,000 ounces, valued at \$15,925,000; lead, 36,000,000 pounds at 4½ cents; nickel, 45,000,000 at 30 cents a pound; silver, 27,500,000 ounces at 54.8 cents; and zinc ore, 13,000 tons, valued at \$310,000. The war has affected metals in various ways. Copper is now selling at 20 cents a pound, nickel about 50 cents a pound, while lead and zinc also show advances in price. The only exception to the general increase is silver, which is now selling about 5 cents an ounce less than last year. It is estimated, however, that the heavy demand for munitions means \$20,000,000 to Canada's mine owners.

Tenders

Bathurst, N.B.—Tenders are being called for the construction of a power house, pumping station, stand pipe, water mains, etc.

Winnipeg, Man.—Tenders addressed to the chairman, Board of Control, will be received up to Friday, July 16, 1915, for the supply of electrodes, glassware and arc lamp cutouts for the City Lighting Department. Instructions to bidders, specifications and form of tender may be obtained at the office of the City Light & Power Department, 54 King street.

Ottawa, Ont.—Tenders for incandescent lamps for public buildings, will be received Tuesday, July 13, 1915. Specifications may be seen on application to Thos. A. Hastings, clerk of works, Postal Station "F," Toronto; to R. L. Deschamps, overseer, Dominion Buildings, Montreal, and to the chief architect, Department of Public Works, Ottawa.

Contracts Awarded

Walkerton, Ont.—The Knechtel Furniture Co. has received an order for 25,000 boxes to hold 4.5 howitzer shells.

Orillia, Ont.—The Orillia Furniture Co. have received an order to manufacture 25,000 ammunition boxes for the British Government.

The Hamilton Bridge Works Co., Hamilton, Ont., have been awarded the contract for the construction of a new steel swing span to cross the lock at Lindsay, Ont.

Hespeler, Ont. The Hespeler Furniture Co. and the W. A. Kribs Co. have received orders for shell and ammunition boxes. These orders will necessi-

tate the installation of special machinery.

Transcona, Man.—At a special meeting of Town Council on June 29 the contract for the pumps for the sewage reservoir was awarded the British Canadian Engineering Co., at \$3,174.34. It was decided to purchase 1,500 feet of fire hose from the Gutta Percha Co. at 80 cents per foot.

Personal

Peter H. Cowan has commenced his duties as waterworks superintendent of the City of Galt, Ont., succeeding Mr. Bartleman, who resigned.

J. C. Rockwell, manager of the Lunenburg Foundry Co., Lunenburg, N.S., died at that place on June 29. Mr. Rockwell, who was born in Cornwallis, N.S., 50 years ago, had been manager of the Lunenburg Foundry Co. since 1899.

Thomas Chater, for 26 years the chief engineer of the Windsor electric lighting plant, died on June 28, aged 60 years. The deceased was born in England, and came to Canada when he was 15 years old. He has lived in Windsor for more than forty years.

Harry F. Barnes, a member of the city engineer's department of London, Ont., has been given an important post in China and sails for that country on July 27 to become instructor of railroad engineering in the State University of Tang Shang, South China.

H. T. Matthew has been appointed Pacific Coast representative for the Society of Electrical Development, New York City. Mr. Matthew was born in St. John, N.B., in 1878, and entered the employ of the McGraw Publishing Co., New York, in 1901, with whom he is still associated.

D. A. Thomas, M.P., who has been appointed munitions agent in Canada and the United States for the British Government, arrived at New York on July 5, on the American liner St. Louis. He was met at the pier by Ambassador Sir Cecil Spring-Rice and Willard D. Strait of J. P. Morgan & Co.

Col. W. M. Davis, formerly city engineer at Woodstock, Ont., and Berlin, Ont., has been selected to command the 54th Kootenay Battalion, which is now being organized at Vernon, B.C. Col. Davis was born at Aylmer, Ont., and graduated from the R.M.C., Kingston, Ont.

Capt. L. A. Demers, Dominion Wreck Commissioner, has completed the investigation into the stranding of the steamship Romney on Greene Island recently. Judgment will be given in a few days. The ship is now in the dry dock at Quebec having some new plates put on the bottom and others rolled again.

Catalogues

Vises.—A leaflet describing and illustrating the all-steel machine vises made by the Cincinnati Milling Machine Co., Cincinnati, O., has come to hand.

Metal Saw Table.—A bulletin describing and illustrating the Acme Metal Saw Table No. 2, manufactured by the Hub Machine & Tool Co., Philadelphia, Pa., has been received. This machine is adapted for cutting sheet copper and brass, tubes, fibre, rubber and other materials.

Centrifugal Compressors for blast furnaces, is the title of bulletin No. 48601, just off the press, and being distributed by the Canadian General Electric Co., Toronto. The advantages claimed for this type of blower over the reciprocating blowing engine are described in detail and the illustrations give a general idea of the design. These latter are supplemented by a description of the compressor including, of course, its principal features and method of operation.

Power Transmission Appliances.—The new "Oneida" line of power transmission appliances is dealt with in bulletin 03, issued by the Oneida Steel Pulley Co., Oneida, N.Y. The principal lines described include drop and post hangers, pillow blocks, couplings, etc. Their principal features are dealt with in detail and price lists give the code words and other useful information for the various sizes of each appliance. The bulletin is fully illustrated.

Cold Storage Doors made by the Jamison Cold Storage Door Co., formerly the Jones Cold Store Door Co., Hagerstown, Md., are dealt with in catalogue No. 7 recently issued. The construction of the "Jones" and "Noequal" cold storage doors, fireproof and non-fireproof is fully described, and is accompanied by illustrations showing the details as designed for coolers and sharp freezers, etc. Particulars are given of cold storage windows, also of revolving and sliding doors. The catalogue contains 96 pages with thumb index and is gotten up in an attractive manner.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Preston, Ont.—The Dominion Bronze Co. have started work on a large order for brass sockets for shells.

Bathurst, N.B.—The town will build a power house, boiler-room and pumping station. John G. Staut is town clerk.

Blenheim, Ont. — The School Board have decided to install a new heating system in the school to cost $2,500. R. L. Gosnell is chairman of the Board.

North Vancouver, B. C.—The Wallace Shipyards and North Shore Iron Works have their plants in readiness to start on the Imperial Government shell order.

Berlin, Ont.—The Water Commission has decided to purchase eight new 3-in. pumps and motors at a cost of $179 each. These will be used on the wells in place of the air-forcing system.

Hamilton, Ont. — The E. T. Wright Co., manufacturers of tinware are considering making a large addition to their factory. An enameling and aluminium plant will be included in the extension.

Thorold, Ont.—The laboratory building, on the premises of the Coniagas Reduction Co., about a mile east of Thorold, was destroyed by fire, together with its contents, on July 13. The loss is estimated at $10,000 which is covered by insurance.

St. Marys, Ont.—The firm of Weir & Weir, have advertised for a site in Stratford suitable for a mill. They claim that the Hydro rates in St. Marys are too high, that they cannot compete with waterpower, and in Stratford their competition would be steampower.

Niagara Falls, Ont.—Work on the construction of an aerial tramway over the Whirlpool has been started by the McLeod Contracting Co. of Toronto. The tramway is being constructed by the Spanish-American Tramway Co., a subsidary of a big Spanish amusement concern.

Municipal

Winnipeg, Man. — The city are considering a proposition for laying 12 miles of gas mains.

Sackville, N.S.—The Town Council have decided to purchase a pump and motor for the waterworks plant.

Rodney, Ont.—A by-law will be voted on by the ratepayers on July 26, to authorize the granting of a loan of $5,000 to the Rodney Woodware Co.

Chatham, Ont.—The city council have recommended the purchase of an aerial truck for the fire department at a cost of about $13,500. A by-law will be voted on.

Exeter, Ont.—By a vote of 247 to 7, the ratepayers of Exeter on July 16 endorsed a Hydro power by-law. The vote calls for the installation of a Hydro-Electric system here, at a cost of $20,000.

Petrolea, Ont. — Petrolea joined the hydro-electric union on July 14, by carrying with a majority of 385 to 10 a by-law calling for the expenditure of $35,000 for the installation of the hydro system. The contract calls for an initial consumption of 500 horse-power at $36.25 per horse-power per annum.

Ottawa, Ont.—The proposed Lemieux Island waterworks scheme includes the trenching and laying of 14,000 lineal feet of 51 in. diameter steel pipe, also the construction of a 4-span concrete bridge. The pumping plant will consist of three motor-driven centrifugal pumps, each having a capacity of twenty million Imperial gallons against a head of 280 feet. Tenders are being called for the above.

General Industrial

Hamilton, Ont.—Work has begun on the excavation for the factory of the T. Eaton Co., of Toronto.

Redcliff, Alta.—D. Broadfoot is endeavoring to make arrangements for the construction of an elevator here.

Collingwood, Ont.—The Bryan Mfg. Co. are asking a loan of $20,000 to assist in the building of a woodenware factory.

Latchford, Ont.—The Canadian Pulp & Lumber Co.'s mill has been destroyed by fire. The loss is estimated at about $50,000.

Aylmer, Que.—An option has been secured on 15 acres of land here for the erection of a sugar factory. D. A. Gordon, of the Dominion Sugar Co., Wallaceburg, Ont., is interested. It is understood that the plant will cost $400,000.

Vancouver, B. C.—H. T. Graham of Belleville, Ont. has purchased the Scottish-Canadian Cannery at Steveston. The plant will be renovated and new machinery installed for handling this season's catch.

Guelph, Ont.—An elevator will be installed at the gas works for unloading coal from the cars. It is also proposed to install a new gas holder next year. The Light and Heat Commission have the matter in hand.

Tenders

Ottawa, Ont.—Tenders on the supply of transformers, switches, and equipment will be received until August 3 by the chairman of the Waterworks Commission. Plans and specifications with the city engineer, R. L. Haycock.

Toronto, Ont. — Tenders will be received up to Tuesday, August 3rd, 1915, for the supply of—58 Tie Rods and Tie plates for Lansdowne Avenue Extension, Toronto Civic Railway. Specifications and forms of tender may be obtained at the Works Department, City Hall.

Winnipeg, Man.—Tenders will be received until Monday, July 26, 1915, for the supply of two 50-light, high efficiency incandescent Street Lighting Equipments, complete with lamps. Instructions to bidders, specifications and form of tender may be obtained at the office of the City Light and Power Department, 54 King Street.

Toronto, Ont.—Tenders will be received until Monday, July 26, 1915, for enlargement Manning Avenue School; new building Manual Training and Domestic Science Departments, King Edward School; iron fence, iron stairs, concrete floors, electrical work, local telephones, and midsummer repairs at sundry schools. Specifications may be seen and all information obtained at the office of the Superintendent of Buildings, City Hall, Toronto.

Oakville, Ont.—Tenders will be received by the chairman of the Oakville Water and Light Commission until Monday, July 26, 1915, for furnishing and installing one electrically-operated turbine pump of 600 Imperial gallons capacity against a head of 300 feet. Specifications may be seen at the office of the

Commissioners, Oakville, or at the office of Chipman & Power, engineers, Mail Building, Toronto.

Personal

A. F. Macallum, city engineer of Hamilton, Ont., has volunteered for active service.

Robert G. Allan, son of one of the founders of the Allan Line, and cousin of Sir Montague Allan, died in London, England, on July 15.

Lieut-Colonel Thomas Cantley has been elected president of the Nova Scotia Steel & Coal Co. He will also retain the position of general manager.

Joseph Austin Holmes, director of the Bureau of Mines Department of the Interior, Washington, D.C., died at Denver, Co., on July 13.

John Palmer, managing director of the Palmer-McClellan shoe factory of Fredericton, N. B., died on July 13, from paralysis. He was 64 years old and had twice been mayor of Fredericton.

J. J. Callaham of the Montreal and Southern Counties Railway, Montreal, Que., has been appointed operating manager of the London and Port Stanley Railway with headquarters at London, Ont.

Aubrey C. White, for over thirty years Deputy Minister in the Department of Lands, Forests and Mines, for the Province of Ontario and a very prominent free-mason, died on July 14 at his summer home in Muskoka, where he had gone for a rest. He was 69 years of age.

J. H. Sherrard, of Montreal, president of the Canadian Manufacturers' Association, is touring the west in furtherance of the project of forming an Exporters' Association to organize the export trade of Canada under the changed conditions caused by the war.

William T. Dunn, formerly tool steel expert for the Carpenter Steel Co. in Boston and New England, has been appointed by the International High Speed Steel Co. of New York district sales agent for New England and Eastern Canada. Mr. Dunn is at present taking a trip through the Cobalt and Porcupine district.

W. H. Westman, president of the Chatham, Ont., Board of Trade, has returned from a business trip to Chicago and points in the south in quest of new industries to locate factories in Chatham. Mr. Westman is in close touch with a number of companies on the other side that may later decide to locate Canadian branches.

Trade Gossip

The Hamilton Facing Mill Co., Hamilton, Ont., have increased their capital stock to $75,000.

Port Credit, Ont.—A Board of Trade has been formed here. W. C. C. Innes is the president.

The Beaver Asbestos Co., have changed their name to that of the Windsor Asbestos Co.

The Canadian Cartridge Co., Hamilton, Ont., has been authorized to increase its capital stock to $150,000.

Guelph, Ont.—It is announced that the Page-Hersey Iron and Tube Co. will resume operations at their plant here in a week or two.

The Rica-Wil Underground Pipe Covering Co., have obtained a license to manufacture pipes and pipe coverings in the Province of Ontario.

P. Lyall & Son Construction Co., Ltd. of Montreal, have obtained an extension of powers to permit them to engage in the manufacture of shells, guns and other munitions.

Montreal, Que.—The plant of the Montreal Technical School will be used for turning out certain lathe attachments and apparatus required for the manufacture of shells. A. Macheras is principal of the school.

The Polson Iron Works, Toronto, have applied to the City Architect's department for permission to make another small addition to their building for the purpose of manufacturing shells.

Catalogues

Gaskets—The Niagara Falls Gasket & Packing Co., Niagara Falls, Ont., has issued a leaflet dealing with their line of metal asbestos gaskets and the Ames alloy metallic sheet packing.

Steel Castings the product of foundries at Windsor, Ont., and Detroit, Mich., are illustrated and described in a catalogue recently issued by the Swedish Crucible Co. The special "Pyro" brand steel castings are included among the others, and in this connection are a few suggestions for successful carbonizing practice.

Frankfort Furnaces made by the strong, Carlisle & Hammond Co., Cleveland, Ohio. Catalogue No. 7 describes the various types of 'Frankfort' furnaces and states for what work each is specially adapted. Tables are included giving dimensions and other particulars for each size, while the concluding pages are devoted to various types of oil and gas burners, tanks, pyrometers, melting pots, etc.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Halifax, N.S.—T. Hogan & Co. will erect a machine shop here.

St. Jerome, Que.—Alfred A. Viau may establish a foundry here.

Brantford, Ont.—The Brantford Computing Scale Co. new factory is nearly completed.

Gondreau, Ont. — The Madoc Mining Co. will build a power house here at a cost of $70,000.

Port Hope, Ont.—The Standard Ideal Co. will probably receive an order for shells. H. T. Bush is general manager.

Charlottetown, P.E.I.—An effort is being made to obtain an order for shells for the Government railway shops here.

Fort Frances, Ont.—The town council will install a steam heating plant. Particulars may be obtained from C. E. Parry, town engineer.

St. Catharines, Ont. — Arrangements are pending for the extension of the Russell Jennings Co. factory to permit of their undertaking the manufacture of munitions.

Chatham, Ont.—At a special meeting of the City Council last Monday it was decided to turn over the Defiance Iron Works to Alex. Chaplin, of this city, for the purpose of manufacturing shells for the Dominion Government. The Defiance Iron Works is owned by the city.

Chatham, Ont.—The City Council recently received a letter from the Marskey & Schmidt Co., of Detroit, offering the city a contract for manufacturing a million shells as part of a ten million shell order which the company claims to have received from the Russian Government. This offer has been handed over to Alex. Chaplin.

Electrical

Otterville, Ont.—A hydro-electric system may be adopted by the town.

Harriston, Ont.—The hydro-electric by-law was carried here last Monday by a majority of 220.

Toronto, Ont.—An electric bell costing $1,400 will be installed on Eglington Avenue at a point where the G. T. R. and C. P. R. intersect.

St. Catharines, Ont.—The Hydro-Electric Commission are considering utilizing the spillways of the Welland Ship Canal for power purposes. This would be of considerable benefit to St. Catharines and district.

The Harrison Landry Mfg. Co., has been incorporated at Ottawa with a capital of $50,000 to carry on business as machinists and engineers, at Montreal, Que. Incorporators Andrew Harrison Landry and Michael Croghan of Montreal.

The Canadian Dadco Co. has been incorporated at Ottawa with a capital of $75,000 to manufacture mechanical metal devices of appliances for cranking and starting automobile or other gas engines at Toronto, Ont. Incorporators, John Cowan and John Thomas Fuller of Toronto.

Preference to Canadian Smelted.—The suggestion was made in the British House of Commons on July 20 by Sir Edward Cornwall that in the event of purchases of spelter being made in America there should be discrimination in favor of metal made in the United States from ores produced in British Columbia. The Ministry of Munitions promised to consider the suggestion.

Municipal

Delta, B.C.—The town will spend $20,000 on waterworks extensions.

Hull, Que.—The city council are in the market for a quantity of cast iron pipe and specials.

Winnipeg, Man.—Extensions will be made shortly to the high-pressure water main system.

Port Rowan, Ont.—The town council are considering the installing of an electric light plant.

Millardville, B.C.—The town council contemplate making extensions to the waterworks system.

Kamsack, Sask. — Additions will be made to the waterworks plant here to cost $35,000. H. H. Crawford is clerk.

Regina, Sask.—The city council has ordered additions to the waterworks plant to cost $44,500. George Beach is city clerk.

Galt, Ont.—A by-law will likely be submitted to the ratepayers to raise $20,000 for the improvement of the waterworks system.

Chambly, Que.—The town council will make extensions to the waterworks system. Motor-driven pumps and steel pipe will be required.

Chatham, Ont.—The town council have passed a by-law for the purchase of motor fire apparatus and truck, at an estimated cost of $13,000.

Canora, Sask.—The town council will install a waterworks plant to cost $17,700. The engineers are Chipman & Power, Toronto, Ont.

Toronto, Ont.—The Board of Control has recommended the purchase of two new electrically-operated pumps for the high-level pumping station.

Carlyle, Sask.—A by-law will be voted on by the ratepayers on August 9 to raise $3,000 for the purpose of completing the electric light and power plant.

Brockville, Ont.—The approval of the Provincial Board of Health is to be obtained re the laying of the proposed intake pipe before the by-law is passed.

Vernon, B.C.—The Municipal Council will build a new auxiliary pumping station to cost $3,000. One large pump and a 50-h.p. motor are required. D. G. Tate is city clerk.

The Pas, Man. — A light and power system will be installed here to cost $50,000. A waterworks and sewage system to cost $80,000 will also be installed. H. H. Elliott is clerk.

Toronto, Ont.—The recommendation of the Works Committee that tenders be invited for the construction of the proposed new duplicate waterworks system, estimated to cost $4,500,000, was rejected, and the matter was referred back for reconsideration.

Tenders

Ottawa, Ont.—Tenders on the supply of transformers, switches, and equipment will be received until August 3 by the chairman of the Waterworks Commission. Plans and specifications with the city engineer, R. L. Haycock.

Ottawa, Ont.—Tenders will be received until August 3 for high lift pumps and motors for the Lemieux Island pumping station. Plans and

If what you want is not advertised in this issue consult the Buyers' Directory at the back.

specifications may be obtained from the consulting engineer, S. B. MacRae, Ottawa.

Brighton, Ont. — Tenders will be received by the undersigned up to July 29, for the erection and completion of a foundry building at Brighton. Plans and specifications may be seen at the office of Geo. Drewry, Secretary of The D. J. Barker Foundry Co., Ltd., Brighton, Ont.

Toronto, Ont.—Tenders will be received up to Tuesday, August 3rd, 1915, for the supply of 58 tie rods and tie plates for Lansdowne Avenue Extension, Toronto Civic Railway. Specifications and forms of tender may be obtained at the Works Department, City Hall.

Ottawa, Ont.—Tenders for harbor and river improvements in the Mission River, Fort William, Ont., will be received at this office until Wednesday, August 4, 1915. Plans, specification and form of contract can be seen and forms of tender obtained at the Department of Public Works, Ottawa, and at the offices of the district engineers, Fort William, Ont.; Confederation Life Buildings, Toronto, Ont.; Shaughnessy Building, Montreal, P.Q.

Drumheller, Alta.—Tenders will be received up till Monday, August 16, 1915, for the following contracts: (1) Supply of about one mile of 6-in. and 4-in. steel or cast iron pipe; (2) valves and hydrants; (3) One return tube boiler and stack; (4) One duplex pump; (5) Materials for 30,000-gallon wood tank and housing; (6) All labor and certain materials for laying water mains, sinking an open well, constructing pumping station, and erecting wood tank and housing. Plans and specifications and other information may be obtained at the offices of the John Galt Engineering Co., Ltd., consulting engineers at Winnipeg and Calgary.

Contracts Awarded

Transcona, Man.—The Ideal Incinerator Co. of Toronto has been awarded a contract for an incinerator to cost $18,875.

Montreal, Que.—The City Council have awarded a contract for fire alarm boxes to the Northern Electric Co., Montreal.

Preston, Ont.—Wirsching Bros., have been awarded the contract for the foundation for the new Hurlbut shoe factory. No other contracts have as yet been let.

Orillia, Ont.—Thos. W. Stephens has been awarded the contract for the construction of the Orillia-Longford pole line by the Light and Power Commission. His tender was $1,250.

Toronto, Ont.—At a meeting of the Finance Committee of the Board of Education held recently contracts representing an expenditure of $30,512 were awarded. The chief amount was for $29,036 which is for the proposed new wing to be constructed to McMurrich Avenue School.

A. R. C. Clark & Son, St. John, N.B. have been awarded the contract for the installation of the water and sewerage system at Bathurst, N.B. The contract, which will amount to $131,000, covers the construction of a dam and pumping station and about seven miles of water and sewerage mains. A large standpipe with a capacity of 405,000 gallons will also be erected.

Assiniboia, Man.—The municipal council have awarded the following contracts in connection with the waterworks extensions: Canadian Iron Pipe Co., 500 tons iron pipe, $19,000; Western Steel & Iron Co., and Canadian Sarco Engineering Co., 130 hydrants, $5,000. All curved extras and special connections will be supplied by the Manitoba Bridge & Iron Works.

Trade Gossip

Edmonton, Alta.—The Edmonton Shell Co. has been incorporated with a capital stock of $50,000 to manufacture shells, explosives, guns, etc.

The Crown Furniture Co. has been licensed to carry on business in the Province of Ontario with a capital not exceeding $40,000. Austin Moss of Preston, Ont., is attorney.

Port Arthur, Ont.—The Western Dry Dock and Shipbuilding Co. is making good progress with the manufacture of its initial lot of farm tractors, plans for which were announced a few weeks ago.

The Goldie & McCulloch Co. of Galt, Ont., are prepared to manufacture fuse caps and such parts required for fixed ammunition except filling with powder. This concern has in operation a large forging and machining plant.

The Lake of the Woods Boat Co. has been granted a license with a capital stock of $80,000, and has appointed William J. Craig, Keewatin, Ont., its attorney. The company will manufacture boats, launches, engines and other equipment.

The Canadian Mill Supplies & Steam Specialties, Ltd., Toronto, Ont., has been incorporated with a capital stock of $40,000 to manufacture machinery and supplies for all industries. The provisional directors are Frank J. Hughes, Thomas B. Smyth and Duncan P. Clark, all of Toronto.

Iroquois Falls, Ont.—The first run of paper from the large Abitibi pulp and paper mill was made last week. Only one unit is running at present, but this will be augmented by two others which are being put up and adjusted. The mill, which is the largest in Canada, will, it is expected, be running full by September.

Semi-finished Steel Short of the Demand.—It is reported from Pittsburgh, Pa., that for the first time in two years manufacturers report a scarcity of semi-finished steel. Pittsburgh producers of open-hearth steel billets and sheet bars have been out of the market, so far as new business is concerned, for some time, but the pressure for delivery on orders booked has been so great that shipments are behind. Youngstown steel makers yesterday advanced the price of sheet bars to $23.50, Pittsburgh, the highest point in more than two years. A month ago sheet bars were available at $20.50, Pittsburgh.

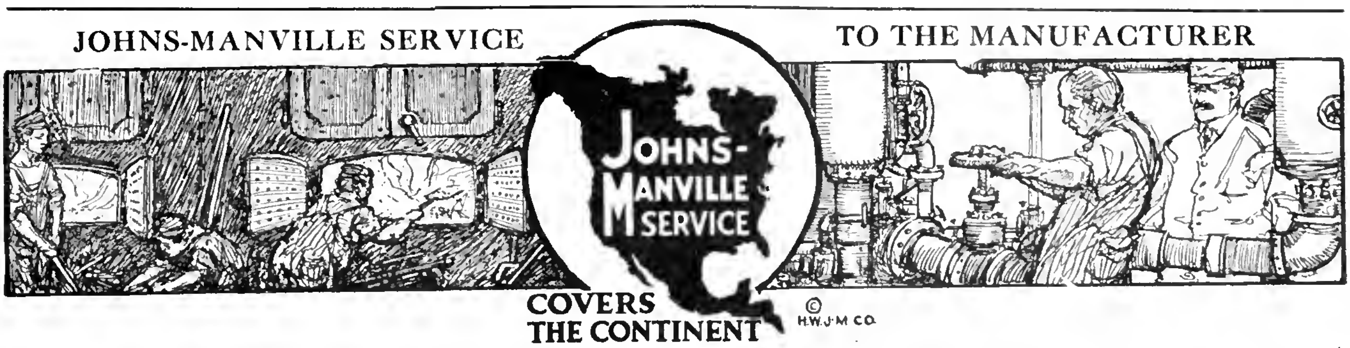
David A. Thomas at Ottawa.—D. A. Thomas, who represents Lloyd George, British Minister of Munitions, in America, arrived in Ottawa on July 25. He is accompanied by Gen. R. H. Mahon and R. H. Carr, and will remain there for some time in close touch with the Canadian Shell Committee. The party will also visit Montreal, Toronto and other cities. Although Mr. Thomas has been given wide powers by the British Minister of Munitions, he states it is not his intention to buy munitions in Canada. The Canadian Shell Committee will attend to that. What his mission is is to inquire into the capacity of the Dominion to turn out shells, rifles, small arms ammunition and explosives.

Personal

A. M. Bray, assistant professor of electrical engineering at McGill University, Montreal, has resigned to become professor of electrical engineering at Cornell University.

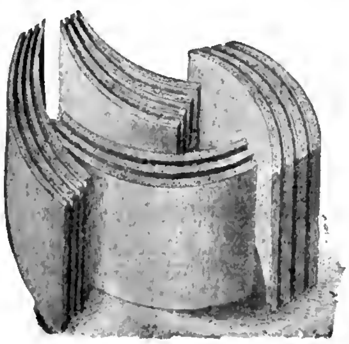
Warren Chambers resigned his position as superintendent with the Chapman Double Ball Bearing Co., Toronto, recently. He has joined the Cobourg Steel Co., which secured a shell contract some time ago.

W. J. McCallum, until recently chief draftsman with the Chapman Double Ball Bearing Co., Ltd., Toronto, has assumed the position of superintendent,



THIS emblem is more than a trade-mark device. It stands for the experience, ability and business integrity of a long-established house. So that any article upon which it appears is not merely offered for sale; it is meant to give service. And that every J-M Product shall give this service fully and permanently, is the whole meaning of J-M Responsibility.

The most important thing about a stack is the draft area. Why choke it up with a thick fire-brick stack lining?



J-M Vitribestos Stack Lining offers even greater lining protection than fire brick, and weighs about 1/10 as much. A six-foot stack lined with J-M Vitribestos allows a net draft diameter of 5′ 8″ and gives maximum draft area.

If you are figuring a new stack, order a lighter gauge material—a lighter foundation and a J-M Vitribestos Lining. You'll have a better stack and a cheaper one.

Vitribestos Stack Lining is impervious to all effects of smoke and fumes of combustion.

It has been a revelation to users. Are you interested in revelations that save money?

Be sure of these three things in planning your pipe covering installation

(1) Proper design of covering.
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(3) Proper application of covering.

These things are all of great and equal importance. You may buy a good covering and pay a fair price for it, but it may not be the covering for your conditions. You may buy a good-looking covering and have it fail on account of its inefficiency, and again the best covering obtainable may be inadequate as a heat insulator if not properly applied.

Johns-Manville Pipe Covering Service satisfies these three conditions of Design, Quality and Installation. This service includes advisory work in planning the job, it includes the *right* covering, of insured quality, and, if you please, it includes the proper installation of same through the contract departments of its branches.

If you prefer to apply these coverings yourself you will appreciate the convenience of materials that go on and come off easily and quickly without breakage or mutilation.

Johns-Manville Pipe Covering Service starts with the plan and stays with the job to the finish.

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rendered vacant by the resignation of Warren Chambers.

H. E. Tanner, formerly assistant town engineer of Chicoutimi, Que., and for three years on the engineering staff of the Transcontinental Railway, has been appointed to succeed Mr. H. Hadley as city engineer of Verdun, Que.

J. Frank Chapman, general manager of the Thousand Islands Railway and the Oshawa Railway, passed away recently at his residence in Gananoque. Ont. The deceased, who was a railroad man of thirty-four years experience, was born in Frankford, Ont., in 1863.

Hurlbut S. Jacoby, formerly chief engineer of the Standard Steel Construction Co., of Welland, Ont., and recently appointed Instructor in Civil Engineering at Pennsylvania State College, has been retained as associate engineer for summer work by the Samuel Austin & Son Co., industrial engineers and builders, of Cleveland, Ohio.

Clark T. Morse, formerly Montreal and Toronto district manager for the Canadian Sirocco Co., has been transferred to the head office at Windsor, Ont., to take charge of the engineering and sales work in place of Ralph T. Coe, resigned. A. M. Nichol continues in charge of Eastern Canadian sales with headquarters in McGill Bldg., Montreal.

Ralph T. Coe, manager of the Canadian Sirocco Co., Windsor, Ont., since the organization of the company, has resigned to enter the engineering service and sales field in New York State. Mr. Coe has been appointed district manager for Warren, Webster & Co. and the American Blower Co., and will have offices at 519 Insurance Bldg., Rochester and 19 Live Stock Exchange Bldg., Buffalo, N.Y.

Sir Sandford Fleming, engineer and scientist, died at Halifax on July 22, after a short illness, at the age of 88. Sir Sandford was known as the dean of the engineering profession in Canada and the "father of the Canadian Pacific Railway." Sandford Fleming was born in Kirkealdy, Fifeshire, Scotland, on January 7, 1827. He was educated there, and came to Canada in 1845. He joined the engineering staff of the Northern Railway, Toronto, subsequently becoming chief engineer. Later he practised engineering in Ontario, and was elected a member of the Institute of Civil Engineers, London, and of the American Society of Engineers, and elected honorary member of the Canadian Society of Civil Engineers. In 1863 he was chosen by the Governments of Canada, Nova Scotia and New Brunswick and Great Britain to conduct a survey for the first link of a railway which would join the Atlantic and the Pacific. His survey showed the practicability of the scheme, which developed, when carried out, into the Canadian Pacific Railway system. He helped to build the railway system of Newfoundland. In recognition of his public services Queen Victoria made him a Companion of the Order of St. Michael and St. George in 1877 and a Knight Commander in 1897.

Wood-Working

Smithville, Ont.—The sawmill of Robert E. Brooks has been destroyed by fire, with a loss of $5,000.

Tenino, B.C.—The plant of the Tenino Lumber Co. has been totally destroyed by fire with a loss of $60,000.

Montreal, Que. — Z. Charbonneau's sash and door factory on Alice street has been destroyed by fire with a loss of $20,000.

Newcastle, N.B.—W. M. Sullivan's mill at Redbank has been destroyed by fire. The loss is estimated at about $40,000.

Monteith, New Ont.—C. Brisbois will build a sawmill and pulp mill here. John Thompson, Peterborough, Ont., is interested in the undertaking.

West Broughton, Que.—T. Beaudouin's saw mill which was totally destroyed by fire with a loss of $8,000, will be rebuilt. Steam power machinery is required.

Goderich, Ont.—A furniture factory is being erected here for J. E. Baechler, Goderich Lumber & Milling Co., who is in the market for wood-working machinery.

North Bay, Ont.—The loss by fire of the Gordon Lumber Co. saw mill at Cache Bay on July 19 amounted to $150,000, of which $75,000 is covered by insurance.

Ottawa, Ont.—The Davidson Woodworking Factory will build a large addition to its plant. Woodworking machinery will be required. L. Henderson is manager.

Haileybury, Ont.—The Dunbar Lumber Co. mill was entirely destroyed by fire on July 13. The loss is estimated at $15,000, of which about $4,500 is covered by insurance.

St. John, N.B.—Fire completely destroyed the Miramichi Pulp Mill property at Chatham, N.B. Only the office building remains. The loss is estimated at $50,000, and is partly covered by insurance.

Berwick, N.S.—Berwick Planing Mills, owned by J. W. Hutchinson, were destroyed by fire on July 14. The loss is over $10,000. In addition to the machinery much valuable lumber was destroyed. There was no insurance.

Building Notes

Beamsville, Ont.—The Board of Education contemplate erecting a school at an estimated cost of $20,000.

Orillia, Ont.—The town council have decided to build a new town hall to replace the building recently destroyed by fire.

Transcona, Man.—It is proposed to build a new school at a cost of $35,000. A by-law will be submitted to the ratepayers.

Winnipeg, Man.—A permit has been granted to build a school at St. Boniface to cost $139,544. The building will be 156 feet x 83 feet and three stories high.

Regina, Sask.—The Robert Simpson Co. of Toronto will erect a building here in connection with their mail order business. The cost is estimated at $150,000.

Chatham, Ont.—The McClary block on King street, recently destroyed by fire, will be rebuilt. A permit has been issued for the work, which it is estimated will cost $10,000.

Levis, Que.—Work is being actively pushed ahead on the construction of the

new Intercolonial freight shed here. The new freight shed is to be 400 x 50 feet, built of concrete, brick and structural steel, and will be thoroughly fire-proof and modern in every detail. The work is in the hands of Mr. G. B. Mitchell, contractor, of Montreal.

General Industrial

Collingwood, Ont.—A by-law will be voted on by the ratepayers on August 11 to grant a loan of $20,000 to the Bryan Manufacturing Co.

Selkirk, Man.—J. S. Hughes, Mill Village, N.S., is interested in a company which will construct a pulp and paper mill at Selkirk, Man., to cost $150,000.

Aurora, Ont.—A syndicate has been formed to establish a plant here for making mechanical orchestras. The Ontario Realty Co., 35 Yonge street, Toronto, are interested.

Railways-Bridges

Alexandria, Ont.—The G. T. R. station here has been completely destroyed by fire.

London, Ont.—The London and Port Stanley Railway was officially opened, by Sir Adam Beck on July 22.

Oil-burning Locos. on G.T.P.—Morley Donaldson, vice-president of the Grand Trunk Pacific Railway, announces that the installation of oil-burning locomotives on the mountain section of the lines has now been completed. These locomotives are of the most modern type and were placed in service for passenger traffic for the first time on July 24. They are operating from Jasper to Prince Rupert, over 719 miles of main line. Especial interest attaches to the installation of this class of motive power, as it marks the first use of oil-burners on an extensive scale in Canada. Oil storage tanks have been erected at various points for supplying locomotives with the necessary fuel.

New Incorporations

The Alton Foundry Co. has been incorporated with a capital of $50,000 to carry on business at Alton, Ont. Incorporators: J. M. Dods, E. Dods and T. B. Deagle, all of Alton, Ont.

The Canadian Ventilator Co. has been incorporated at Ottawa with a capital of $50,000 to manufacture ventilators, screens, etc., at Ottawa. Arthur Ellis, Robert A. Devine and Howard Murray, all of Ottawa, Ont., incorporators.

Classified Advertisements

¶ Those who wish to sell or buy a business, obtain competent help, connect with satisfactory positions, or secure aid in starting new enterprises, should not fail to use the Want Ad. Page of "CANADIAN MACHINERY."

WANTED — EQUIPMENT FOR MACHINE (repair) shop; weight or accuracy not important as price. Give full details. Box 153, Canadian Machinery. (8)

The Lachine Manufacturing Co., has been incorporated at Ottawa with a capital of $120,000 to manufacture bombs and other munitions of war at Lachine, Que. Incorporators—Joseph Descarries and Theophile N. Descarries, of Lachine.

The W. J. Trick Co. has been incorporated at Toronto with a capital of $250,000 to manufacture interior fittings and all kinds of woodwork at Oshawa, Ont. Incorporators: John Fraser Macgregor and Thomas Stewart Hagan Giles, of Toronto.

The Waterproof Stockings, Ltd., has been incorporated at Toronto with a capital of $50,000 to manufacture rubber goods and dry goods of all kinds at Toronto. Incorporators: Frederick Charles Stewart and George Alfred Stewart of Toronto.

The Architectural Woodworking Co. has been incorporated at Ottawa with a capital of $50,000 to manufacture all kinds of office equipment, store fixtures and revolving doors, etc., at Toronto, Ont. William A. Riddell and Harvey Obee, of Toronto.

The Canadian Mills Supplies & Steam Specialties, Ltd., has been incorporated at Ottawa with a capital of $40,000 to manufacture machinery and supplies for all industries at Toronto, Ont. Incorporators, Frank Joseph Hughes, Daniel Kelly, of Toronto.

The St. Thomas Construction Co. has been incorporated at Ottawa with a capital of $40,000 to manufacture shrapnel and high explosive shells at St. Thomas, Ont. Incorporators: Albert Edward Ponsford and Edward Austin Horton of St. Thomas, Ont.

Dominion Aluminum Last Co. has been incorporated at Ottawa with a capital of $50,000 to manufacture boot and shoe lasts, etc., at Windsor, Ont. George A. Farabaugh, William H. Holland and George Chester Clarke, all of South Bend, Ind., incorporators.

The Boving Hydraulic and Engineering Co. has been incorporated at Ottawa with a capital of $500,000 to carry on business as mechanical, hydraulic engineers and contractors at Lindsay, Ont. Donald McLean, James Boxall and William Flavelle, all of Lindsay, Ont., are the incorporators.

Refrigeration

Halifax, N.S.—The City Council have appointed a committee to look into the question of establishing a municipal abattoir. It is estimated that it will cost about $70,000.

The Anglo American Pork Products Co. has been incorporated at Ottawa,

with a capital of $5,000, to manufacture and refine oils, greases, paint and oil products, etc., at Toronto. Incorporators: Harry Riley and Alfred Bicknell, of Toronto.

Marine

Midland, Ont.—The new locks at Port Severn were officially opened on July 26. This point is the Georgian Bay end of the Trent canal.

Kingston, Ont.—After being in commission for 25 years or more, the Dominion Public Works dredge 105 is to be placed on the scrap heap at Ottawa. For the past 8 months this dredge has been engaged deepening the harbor at Bowmanville.

St. John's, Nfld.—The purchase by the Russian Government of the ice-breaking steamer Bruce from the Reid Newfoundland Co. is announced. It is understood that the Bruce, with her sister ship, Lintrose, bought by Russia last winter, will be used in the White Sea during the fall and winter in an effort to keep open later than usual the channel to the port of Archangel. The Bruce and the Lintrose were built a few years ago for service in Cabot Strait, between Newfoundland and Cape Breton, where heavy ice is encountered in the winter. They are steamers of 1,553 tons.

Too Big for Canal.—William G. Davidson, president of the Staten Island Shipbuilding Co., has just purchased four of the large vessels of the Erie Railroads Lake Line, the Brownell, Underwood, Binghampton and Oswego. President F. D. Underwood of the Erie Railroad has made announcement of the sale. The big vessels are too large to go through the Welland Canal, so they will be cut in two and towed through in that manner. The cutting will be done in Buffalo, and the approximate cost of the cutting, towing and insurance will be $25,000. The boats will be used in the coastwise and trans-Atlantic trade.

Catalogues

Grinding and Polishing Machines made by J. G. Blount Co., Everett, Mass. A new catalogue, No. 17, describes at length a complete line of grinding and polishing machinery and speed lathes. Specifications giving the principal dimensions of each type of machine are included and numerous illustrations show the distinctive features embodied in the design of the various types. Copies may be had on application.

Marine Engines.—Catalogue No. 11, issued by the Gas Engine & Power Co., and Charles L. Seabury & Co., Consolidated, New York City, describes the Seabury marine engines for commercial and pleasure craft. A description covering the design of this type of engine is given accompanied by a number of illustrations. A list of the various sizes is included giving the principal dimensions for various horse powers.

Centrifugal Pumps is the title of a 64-page bulletin just issued by the Terry Steam Turbine Co., Hartford, Conn., giving details and data on various turbo-pump applications. The principles of operation and construction of the centrifugal pump are clearly explained, as are the details of the steam turbines which have been successfully used during the past ten years for driving them. This booklet should be in the hands of those who are interested in any kind of a pumping problem. Copies may be obtained on application.

Steel Poles for telephone, telegraph, trolley and transmission lines, etc., is the subject matter of a new catalogue issued by the Carbo Steel Post Co., Chicago, Ill. The "Carbo" steel pole is featured and the principles involved in their design, adaptability, durability and construction. A detailed comparison is made between "Carbo" steel and wooden poles for transmission lines as regards cost of installing, length of service, etc.

Steam Traps.—The Morehead Mfg. Co., Detroit, Mich., have issued catalogue No. 11, dealing with the "Morehead" tilting steam traps and comprising a description of the Morehead "Back to Boiler System" of steam drainage and boiler feeding. The catalogue contains 64 pages and the matter is well arranged. The construction and operation of the various types of steam traps are fully described and illustrated and their principal features dealt with at length. Numerous illustrations are given of plants with the traps installed as part of the "Morehead" system, and showing the wide and varied application of these traps. The illustrations are accompanied by brief descriptions stating the type of trap installed and the kind of plant.

Wagon and Truck Loaders.—The Link-Belt Co., Chicago, Ill., are distributing their new portable wagon loader catalogue No. 210, which describes the machine claimed to load a wagon or truck with material carried on the ground at the rate of one ton per minute. Specifications and price lists are given for each type of machine and numerous illustrations show the wide range of work and various materials these loaders are capable of handling. A number of tes-

timonials and partial list of users are also included.

Slotting Machines.—The Newton Machine Tool Works, Philadelphia, Pa., present their new catalogue, No. 49, dealing with a complete line of standard and special slotters. Specifications giving the principal dimensions of each type are included, accompanied by illustrations. These latter also show machines driven by belt, the pneumatic clutch and reversible motor, in addition to the crank and screw driven machines. A further series of illustrations in the form of an insert show many designs of milling, boring, drilling, and cold saw cutting-off machines.

Steel Split Pulleys.—An attractive catalogue issued by the Keystone Pulley Co., Oneida, N.Y., contains particulars covering the "Keystone" steel split pulleys. The principal features incorporated in the design of these pulleys are described in detail and the illustrations give a good general idea of their construction. Price lists and shipping weights are given for each size and the illustrations show the various types of pulley and also interior views of the factory where they are made. The catalogue concludes with some useful rules for finding pulley diameters and speeds.

Lagonda Vibrator Cleaners is the name of the latest catalogue of the Lagonda Manufacturing Co., Springfield, Ohio. This bulletin discusses formation and removal of scale from fire tube boilers, and describes and illustrates the new Lagonda Vibrator Cleaner, which is proving most highly effective in removing scale from fire tubes. The cleaner also loosens the soot on the interior of the tubes and it is blown out by the air or steam exhausting from the front end of the turbine. The turbine used in this cleaner is the Lagonda high efficiency, high power, air or steam driven machine. Copy of this bulletin will be sent to anyone on request.

Centrifugal Blowers and Compressors for all pressures from 5 ins. of water, as in mechanical draft service, up to 125 lbs. per square inch, as for compressed air distribution in mines, machine shops, ship yards, etc., are described in a 64-page book issued by the DeLaval Steam Turbine Co., of Trenton, N.J. The development of the high efficiency, high-speed centrifugal blower or compressor has been conditional upon improvements in materials, construction, shop practice and design such as are employed in the building of high-grade steam turbines. By careful calculation of stresses, and by the use of good materials and workmanship, it is possible to run blower and compressor wheels safely and satisfactorily at peripheral velocities of 450 to 600 ft. per second, which makes it pos-

sible to develop as much as 3 or 4 lbs. per square inch pressure in a single-stage blower. In the present publication numerous charts are given showing curves for the isothermal, adiabatic and actual compression of air, also the theoretical power required to compress air and characteristic curves of single—and multi-stage blowers and compressors. The influence of impeller design upon the form of the characteristic is discussed at some length. Particulars are given concerning the application of centrifugal blowers and compressors to forced draft, coal gas manufacture, coke oven plants and water-gas plants, sugar factories, cupola and blast furnace work, Bessemer converters, supplying compressed air in mines, ship yards, etc. The illustrations present numerous examples of blowers and compressors directly connected to steam turbines and to electric motors.

Book Reviews

A Study of Boiler Losses, by A. P. Kratz, has been issued as Bulletin No. 78 of the Engineering Experiment Station of the University of Illinois. This bulletin presents a critical analysis of the data obtained from a series of twenty-five trials made on a 500 horse-power Babcock and Wilcox boiler located in the heating plant of the University. The boiler was operated under varying conditions of load and depth of fuel bed. Curves are presented and conclusions are drawn regarding the conditions necessary in order to secure the best continuous operation. In these tests, gas samples were taken both at the bridge and in the breeching, and a determination of the loss due to air leaking through the setting was made. A curve is also given which shows the percentage of excess air represented by the different amounts of CO_2 appearing in the gas. The heat balance has been subdivided so as to isolate and determine the amount of the several losses chargeable to the boiler, furnace and setting. Complete forms for calculating a series of boiler trials are given, and the corrections for differences in pressure and water levels at the beginning and end of a test are discussed. Tests were also made using some samples of coal which had been exposed to the weather for about six years. An interesting fact brought out was that no difficulty was experienced in burning the weathered coal. It had deteriorated until it was of about the same composition and grade as the fresh Vermilion County screenings, and its steaming qualities compared very favorably with those of the latter. Copies of Bulletin No. 78 may be obtained gratis upon application to C. R. Richards, Acting Director of the Engineering Experiment Station, University of Illinois, Urbana, Ill.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Niagara Falls, Ont.—Fire did $1,000 damage to the melting room of the Pollard Mfg. Co. foundry.

Toronto, Ont.—The Canada Metal Co. are making extensions to their factory at a cost of $15,000.

St. Catharines, Ont.—The McKinnon Dash & Metal Works will start the construction of an addition.

Calgary, Alta—The Canadian Pacific Railway is increasing its shell-making facilities at the shops here.

Welland, Ont.—The Canadian Billings & Spencer Co. will purchase forge and metal-working machinery to cost $30,000.

Truro, N.S—The Truro Engineering Co. will install $27,000 worth of machinery in its plant for the manufacture of shells.

Port Arthur, Ont.—The Western Dry Dock & Shipbuilding Co. has received a new order for a large number of high explosive eighteen-pound shells.

Calgary, Alta.—DuCane, Dutcher & Co., consulting engineers, of Vancouver, B.C., are working on a hydro-electric power project on the Elbow river near here.

St. Thomas, Ont.—The St. Thomas Construction Co., who have taken over the Steel Vault Co. plant in order to make shells, are in the market for machinery for this purpose.

Montreal, Que—The Aetna Chemical Co., will build a plant at Drummondville, Que. The general contract has been awarded to the Westinghouse, Church, Kerr & Co., Montreal.

Toronto, Ont.—A building permit has been issued to the Polson Iron Works for the erection of a one-storey frame and metal addition to their factory on the Esplanade, costing $3,000.

St. Catharines, Ont.—Work will be started at once on the construction of an addition to the factory of the Whitman & Barnes Mfg. Co. The new structure will enlarge the forge room to double its present size.

Stratford, Ont.—R. C. Bartlett has secured the Morelock factory building and will install machinery and equipment for the manufacture of automobiles. Mr. Bartlett has been manufacturing automobiles in Toronto, Ont., for some time.

Hamilton, Ont.—The Canadian Cartridge Co. will spend $150,000 on machinery to be installed in its plant which is being erected here. A main building, to cost $30,000, and a boiler house and machine shop will be constructed first. The total investment will be $250,000.

Ford, Ont.—Work on another new addition to the plant of the Ford Motor Co., at an estimated cost of $60,000, has been started. It will extend for 705 feet along the Detroit River frontage. The building will be one storey high, of concrete with a steel "saw tooth" roof. It will be devoted entirely to machine shop work.

Quebec, Que.—G. B. Mitchell, of Montreal, has just been granted a sub-contract by M. P. & J. T. Davis, the contractors of the Lauzon Dry Dock, for the construction of the new power house for the latter. The power house will be 120 x 100 feet, of brick and steel. The smoke stack will be of brick, 180 feet high, 20 feet in circumference at the base and 14 feet at the top. The pump house will be 50 x 70 feet.

Electrical

Blenheim, Ont.—Work will start shortly on the construction of the sub-station in connection with the hydro-electric system.

Municipal

Colborne, Ont.—The town council will buy a fire engine. The by-law has passed.

Melfort, Ont.—The town will spend $2,500 on extensions to the telephone system.

Matheson, Ont.—The town will spend $20,000 on the construction of a waterworks system.

Outremont, Que.—The City Council have decided to buy a combined sprinkler and flushing machine.

Palmerston, Ont.—A by-law providing for the installation of a hydro-electric system will be submitted to the ratepayers on August 7th.

Meaford, Ont.—A by-law will be voted on by the ratepayers on Aug. 16 to authorize the expenditure of $4,000 on waterworks extensions.

Milverton, Ont.—By a majority of 155—only seven ratepayers voting against the measure—Milverton carried a hydro-electric by-law on July 30.

Carlyle, Sask.—A by-law will be voted on by the ratepayers on Aug. 9 for the purpose of raising $3,000 to complete the civic power plant.

Lennoxville, Que.—A by-law has been passed authorizing the purchase of the waterworks, and the expenditure of $14,000 on repairs and extensions.

London, Ont.—It is proposed to spend $62,000 on electric light plant and $30,000 on waterworks extensions. A by-law will be submitted to the ratepayers.

Markham, Ont.—It is estimated that the proposed extensions to the waterworks system will cost $15,000. E. A. James, Adelaide street, Toronto, is the engineer.

Montreal, Que.—It is expected that a retaining wall will have to be built to protect the aqueduct. The length of wall will be about seven miles and the cost approximately one million dollars.

Brockville, Ont. — Dr. McCullough, chief medical officer of health for Ontario, has written the chairman of the Board of Water and Light Commission approving of the location of the proposed new intake pipe at the pumping station. To ensure a pure water supply, Dr. McCullough insists upon the installation of a filtration plant.

General Industrial

Galt, Ont.—Getty & Scott, Ltd., propose making an extension to their factory.

Calgary, Alta.—The Southern Alberta Refineries, Ltd., will establish a refinery near here.

Louisburgh, N. S.—The Marconi Wireless Telegraph Co. will make extensive alterations and additions to its plant.

Chatham, N. B.—The Miramichi pulp mill of the Dominion Pulp Co was de-

stroyed by fire recently with a loss of $50,000.

Calgary, Alta.—The Western Canada Flour Mills Co. have started construction work on five of its ten new elevator plants to be built at once in Alberta. The five points at which work is now progressing are, Ensign, Kircaldy, Champion, Dalmead and Street, Alberta, and five more points, yet to be chosen, will each get one of the new elevators. The new elevators will be built at a cost of $75,000.

Tenders

Regina, Sask.—Tenders will be received by the City Commissioners up till Monday, September 6th, 1915, for the supply, delivery and erection of a 7,000,000 gallon pumping unit at the city power house. Specifications and other information may be obtained from J. M. MacKay, Superintendent of waterworks, Regina, Sask.

Contracts Awarded

Strathroy, Ont.—The Nicholson Planing Mills have received an order for shell boxes.

Lachine, Que.—The city council has awarded the contracts for the supply of cast-iron water pipe to the Dominion Bridge Co.

Windsor, Ont. — The city council awarded the contract for the supply of cast iron water pipe to the National Iron Works, Ltd., Toronto, at $30.25 per ton, and for specials, valves, hydrants, etc., to the Kerr Engine Works, Walkerville, Ont.

Building Notes

Barrie, Ont.—Work will commence at once on a new $15,000 Carnegie Library.

Toronto, Ont.—The city architect's department has issued a building permit to Gunn's Limited for the erection of a two-storey corrugated iron warehouse, costing $6,000, on Symes road, near Scarlett road.

Toronto, Ont.—A building permit was this morning issued to the Dunlop Tire & Rubber Goods Co., for the erection on Booth avenue near Queen street of a three-storey brick addition to their factory costing $30,000.

Railways-Bridges

Toronto, Ont.—Plans for the construction of the new pedestrian subway under the tracks at Ashdale Avenue will shortly be submitted to the Dominion Railway Board for approval. The estimated cost is $11,500.

Fredericton, N.B.—Premier Clarke has announced that borings would be made for the proposed bridge crossing for the St. John Valley Railway at Gorham's Bluff, near the Mistake. This work is to start as soon as arrangements can be made to have the drilling outfit taken to Gorham's Bluff and will be rushed to completion. Premier Clarke stated that this course had been finally decided upon by the government.

Wood-Working

Martintown, Ont.—A. D. Clinger's sawmill has been destroyed by fire. The loss is estimated at $8,000.

Ditchfield, Que.—Fire recently destroyed the saw mill belonging to P. H. Renaud. Loss is estimated at $6,000, which is covered by insurance.

Marine

Kingston, Ont.—Navigation on the Rideau is practically at a standstill. All season the steamer Rideau Queen has been unable to proceed as far as Smith's Falls, owing to low water. On July 27, the steamer was taken off the route entirely. Lately she has been able to go only as far as Portland.

S.S. Parima Damaged.—The freighter Parima, of the Quebec Steamship Co., was damaged by fire on July 29, at Hoboken, N.J., where the ship was undergoing repairs. The fire is believed to have started in a pile of rubbish collected for removal. An investigation is being made to determine whether the blaze was of accidental or incendiary origin.

Refrigeration

Ingersoll, Ont.—A large cold storage plant and tin shop will be constructed by the Borden Milk Co.

Personal

J. T. Breckon, waterworks engineer for the city of Vancouver, B.C., has resigned.

R. H. Parsons, superintendent of the municipal power plant at Edmonton, Alta., has resigned.

M. S. Gibson has been appointed general manager of the National Fireproofing Co. of Canada, Ltd., with headquarters at Toronto.

Hon. Jean Provost, ex-Premier of Colonization, Mines and Fisheries in the Gouin Government, and member of the Legislature for Terrebonne, died at Quebec on July 26, in his forty-sixth year.

M. J. Butler, C.M.G., of Armstrong, Whitworth of Canada, Ltd., is to be appointed consulting engineer of the Montreal city waterworks, which will include the construction of the filtration plant and the widening of the aqueduct.

Joseph R. Henderson, of Montreal, president and general manager of Brandram-Henderson, Ltd., Montreal and Halifax, manufacturers of paints, etc., died suddenly in Halifax on July 31. He was born in Hexham, Northumberland, England, in August, 1851. He will be buried in Halifax.

Trade Gossip

Vancouver, B.C.—It is reported that the plant of the Ocean Falls Co. will be re-opened.

The Cedars Rapids Manufacturing & Power Co., have under consideration adding 10,000 to 30,000 horse power to the capacity of the plant.

The General Car & Machinery Works, Ltd., of Montmagny, P.Q., makers of road machinery, have opened an office at 317 St. James street, Montreal, under the managership of J. H. Langis.

Canadian Shipping. — During 1914 there were constructed in Canada 43,346 tons of new shipping, which at $30 per ton, as a fair average value, makes the total value of vessels entered on the Canadian registry $27,972,000. The tonnage constructed in 1914 is the largest annual output of the Dominion in 15 years.

Scarcity of Coal Freighters.—The Sydney Record says that owing to scarcity of ships, it understands that negotiations are in progress between the Dominion Coal Co. and the Intercolonial Railway for the shipment of a large tonnage of coal from Sydney to Quebec and Montreal by rail. Owing to a quietness in freight business, it is considered possible an arrangement will be concluded at a tariff profitable to the railway and satisfactory to the Coal Co.

Aetna Explosives Co.—The big plant of the Aetna Explosives Company, upon which operations are being rushed at Drummondville, Que., will stand as one of the important industries which the war business has brought to Canada. A subsidiary of the Aetna Explosives Co. of the United States, it will be backed entirely by American capital, but the

THE A. R. WILLIAMS MACHINERY CO., LTD.

ST. JOHN, N.B. TORONTO WINNIPEG VANCOUVER

Canada's Leading Machinery House

Two Notable Labor-Saving Devices for Increasing Production

CURTIS SAND BLASTS

Have maximum abrasive action and embody many features that save time and labor not included in the design of other makes. For cleaning scale from shrapnel cases and preparing the interior of high explosives for varnishing.

Get information on the CURTIS JACK for handling hollow forgings for external or internal sand-blasting.

THE ECLIPSE AIR BRUSH

For applying varnish to the interior of high explosives or painting the exterior, the Eclipse is unrivalled in the economy of material and time and labor-saving efficiency.

Get information on special motor-driven rotating stand for handling this work on a quantity basis.

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Machine Tool Department

HANG THIS UP

There is a Geometric Die Head on every make of screw machine engaged in thread cutting.

Some day we will ask you to strike out the word "make," for it is our purpose to put a Geometric Die Head on every screw machine engaged in thread cutting.

Every condition fosters this expectation :—

Die Heads that are indispensable to those who have used them.

Expert workmen.

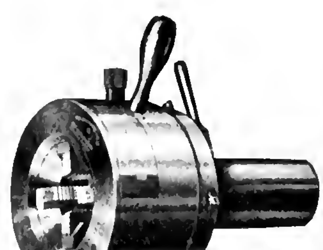
Business integrity.

A reputation that is sound.

A strong faith in The Geometric Tool Company, its products and its customers.

DO YOU KNOW WHAT GEOMETRIC SATISFACTION IS?

You probably do not know how satisfied you can be with your Screw Threading Operations unless you know what Geometric Satisfaction is.



Ask us about it in connection with your requirements.

THE GEOMETRIC TOOL CO., NEW HAVEN, CONN., U. S. A.

Canadian Agents:—Williams & Wilson, Ltd., Montreal; The A. R. Williams Mchy. Co., Ltd., Toronto, Winnipeg, St. John, N.B.

business for the time being at least will be the outcome of the big contract which the company secured from the Canadian Car & Foundry Co. to supply explosives in connection with the Russian shell order. The company has secured a big site outside the town of Drummondville, and the plant will probably cost $500,000 and employ a large number of hands. The operation of the works is expected to commence in the course of a few months to fill contracts this fall.

Catalogues

The Universal Iron & Supply Co., St. Louis, Mo., have issued a leaflet giving particulars of storage tanks with sketches of various types. An interesting feature is a calibration curve for horizontal cylindrical tanks of any dimensions.

The Providence Engineering Works, Providence, R.I., have mailed a bulletin describing the "Providence" shaper which they are putting on the market. The essential features incorporated in the design of this machine are dealt with, and a brief specification is included giving the principal dimensions. Two illustrations give a general idea of the style of machine.

The Sunbeam Index to the proper lighting of homes is the title of a bulletin issued by the Canadian General Electric Co., Toronto. The bulletin contains much useful information on the illumination of the various parts of a house accompanied by a table on the selection of the right lamp. Another table gives the cost of electricity for the various electrical devices used around the home.

Pulleys—The Oneida Steel Pulley Co., Oneida, N.Y., have issued a new general catalogue No. 5 dealing with a complete line of pulleys of both steel and wood construction. The principal features embodied in the design of these pulleys are described in detail with explanatory illustrations. Price lists are included and also tables giving weights of stock sizes and a telegraph code. The catalogue concludes with a number of mechanical tables.

Electric Furnaces made by the Canadian Hoskins, Ltd., Walkerville, Ont., are described in bulletin No. 12. Full particulars are given covering the construction, temperatures, operation and uses of furnaces, together with dimensions and price of each size. Other lines dealt with include thermo-electric pyrometers, portable and wall meters, etc. Inserted leaflets illustrate and describe the "Stewart" combination furnace,

gas and oil furnaces and a recalescent outfit. The catalogue is fully illustrated.

Power Transmission Appliances. — The "Keystone" line of improved appliances for power transmission is the subject of introductory bulletin K2 issued by the Keystone Pulley Co., Oneida, N.Y. The line dealt with in this bulletin consists principally of various types of shaft hangers and pillow blocks, but safety set collars, flange and clutch couplings are also included. The principal features of these products are clearly explained accompanied by illustrations and diagrams. Several tables give dimensions and prices for each size.

The Gisholt Machine Co., Madison, Wis., have sent us a copy of their new catalogue K3 describing the "Gisholt Universal Tool Grinder." The catalogue contains a matter of 32 pages and is gotten up in an attractive style. The opening pages deal with the advantages to be gained by using this machine. Following are three or four pages devoted to tool grinding by the "Gisholt" method including a number of settings for grinding the different cutters, illustrated. Pages 16 and 18 deal respectively with grinding inserted tool, post tools and the correct forging of tools. Pages 20 and 21 give the principal dimensions and weights and also a list of parts, illustrated, of the tool grinder. Pages 22 to 26 inclusive contain a general description of the machine together with cross sections and a floor plan. The succeeding pages deal briefly with turret lathes and boring mills, and conclude with a map showing the location of Madison accompanied by an invitation to visit that city. The illustrations are exceptionally good and include views of tool rooms, two grinding charts, a sample of tools ground on this grinder, in addition to those already referred to.

Book Reviews

Submarines, Torpedoes, and Mines, by W. E. Dommett, 106 pages 7¼ inches, 21 illustrations and 16 full size plates. Published by Whittaker & Co., London, and New York, price 25c net. This is the second impression of an exceedingly interesting little volume, especially so at the present time when the work of submarines is so much before the public. The author states that in the preparation of this book, the endeavor has been to present the subject in such a manner that it shall be understood by, and together with the plates, be of interest to the general reader, and at the same time contain sufficient technical matter to be of value to the reader having some technical knowledge. The latter feature, however is limited to some extent by the necessity for secrecy enjoined by the various governments or private yards building submarines. That

the book is up to date is proved by the reference to incidents of the present war; viz., the action at Heligoland Bight and the feat of the B. 11 in penetrating the Dardanelles and torpeding a Turkish warship. The book contains ten chapters with the following headings:—Historical, British naval submarines, submarine tactics, steering and manoeuvring apparatus, propelling plant, armament, navigation fittings, routine on submarines, mines, and lastly auxiliary vessels. It will be noted from the above that submarines and their constructions have been covered quite comprehensively. The plates sixteen in number, are excellent reproductions and show various types of submarine craft, while twenty-one illustrations show the propelling engines and other details. Among the latter is included a folding plate illustrating the interior of a submarine. The chapters on torpedoes and mines are also equally interesting, the illustrations being of considerable help to a clear understanding of the text.

HASTE AND WASTE.

IT is hurry in the morning, hurry at noon-time, and hurry at night. Nervous bodies, wrought up to a certain speed, fret away pleasure and good nature just to keep up the pace. Relaxation becomes almost painful—rest a farce. To be in any measure content one feels it necessary to be rushing along "breakneck." No more is accomplished, homes are not the brighter, children the happier, or lives made more useful by all this rush. Yet we keep it up.

One has only to watch the crowds in the cities going to trains or cars to see the working out of the speed mania. Rights of others are forgotten, personal safety seems naught, just crowd, push and get ahead. Strange to say, however, we do not get ahead as quickly as we would if we were to move in a more leisurely manner.

Haste makes waste, and waste is expensive in the extreme. Some persons are too busy to attend to that which insures themselves good health. They expect to mend a broken auto tire hastily and with no skill.

This is an impossibility, but that is not taken into consideration; and so the haste and waste go on, and every day comparatively young men and women let slip from their hands all that is useful and happy in life. Their grasp has grown weak and nothing can be held longer. All due to the daily rush of eating, of working, of walking—everything done hastily, with only a thought for saving an hour or two. Think it over!—Todge Idea.

THE A. R. WILLIAMS MACHINERY CO., LTD.

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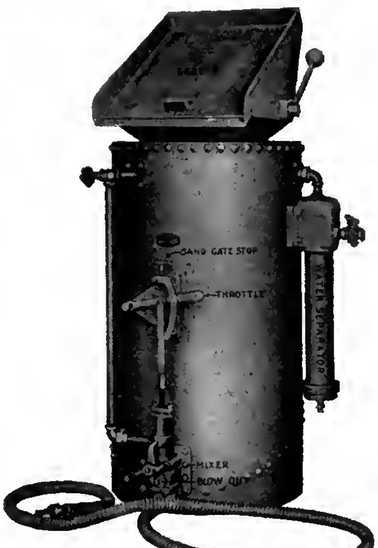
Canada's Leading Machinery House



Two Notable Labor-Saving Devices for Increasing Production

CURTIS SAND BLASTS

Have maximum abrasive action and embody many features that save time and labor not included in the design of other makes. For cleaning scale from shrapnel cases and preparing the interior of high explosives for varnishing.

Get information on the CURTIS JACK for handling hollow forgings for external or internal sand-blasting.

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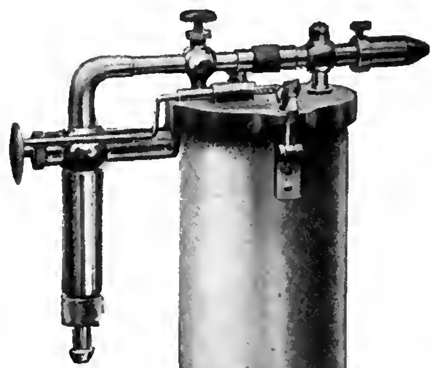
For applying varnish to the interior of high explosives or painting the exterior, the Eclipse is unrivalled in the economy of material and time and labor-saving efficiency.

Get information on special motor-driven rotating stand for handling this work on a quantity basis.



REMEMBER OUR SERVICE DEPARTMENT IS ALWAYS AT YOUR DISPOSAL

THE A. R. WILLIAMS MACHINERY COMPANY, LIMITED

Machine Tool Department

WHAT REASON HAVE YOU

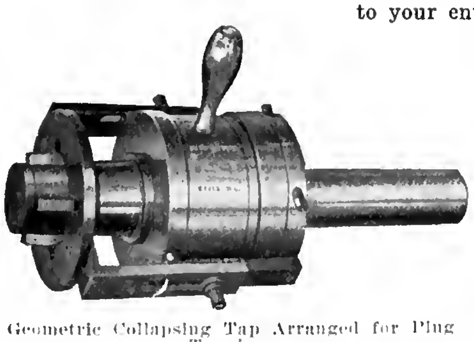
For not using a Geometric Collapsing Tap in tapping out holes above ¾-inch diameter?

Your rate of production would be increased, and your cost of production decreased.

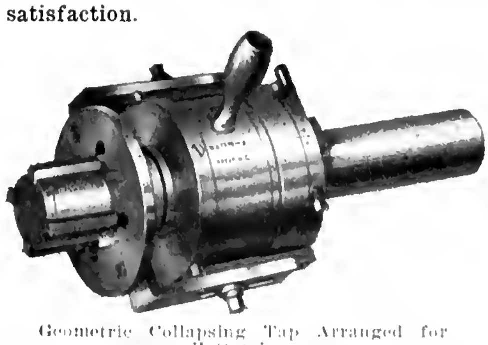
Geometric Collapsing Taps require no backing out over the threads. They are rigid while cutting, but collapse their chasers at the prescribed depth of thread.

It makes no difference what the thread is, a Geometric Collapsing Tap can be furnished that will produce it

to your entire satisfaction.



Geometric Collapsing Tap Arranged for Plug Tapping.



Geometric Collapsing Tap Arranged for Bottoming.

We will fit the tap with whatever size shank your machine requires. Send specifications of your work, and our experts will make a study of it and tell you what we can do for you.

Look over our catalogue. Get in touch with us, at least.

The Geometric Tool Company, New Haven, Conn., U.S.A.

CANADIAN AGENTS:

Williams & Wilson, Limited, Montreal. The A. R. Williams Machinery Co., Limited, Toronto, Winnipeg, St. John, N.B.

If what you want is not advertised in this issue consult the Buyers' Directory at the back.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Cobalt, Ont.—The Coniagas Mining Co. will build a new cyanide mill.

Mount Brydges, Ont.—It is probable that an automobile factory will be built here.

Galt, Ont.—The Galt Machine Screw Co. has purchased a site in Jackson Park, and will build a new plant there.

Chatham, N.B.—The Maritime Foundry Co.'s new shell plant is under construction. The building is 100 x 40 feet.

Walkerville, Ont. — The Dominion Stamping Co. will make an extension to their plant.

Goderich, Ont.—The Doty Engine Co. have received an order for 4.5 high explosive shells.

Berlin, Ont.—The Central Heating Co. have ordered two 300 h.p. boilers from the Babcock & Wilcox Co.

Winnipeg, Man.—The city is contemplating making an extension to the power plant at the municipal hospital.

Brampton, Ont.—A company has been formed to make shells here. A factory building on Nelson Street will be utilized.

Renfrew, Ont.—It is reported that M. J. O'Brien is interested in a proposition to establish a factory here for making shells.

Montreal, Que.—The Canada National Gas Co. are calling tenders for the laying of a pipe line from the wells at St. Barnaby to the city of Montreal, a distance of 40 miles. The cost is estimated at about $200,000.

Electrical

Peterborough, Ont.—It is stated that the Hydro-Electric Commission will take over the Healey Falls dam, the property of the Seymour Power Co.

Palmerston, Ont.—The obtaining bylaw for Ontario hydro-electric power was voted on here on Aug. 4, and carried almost unanimously. The projected line starts near Mitchell and supplies Milverton, Listowel, Palmerston, Harriston and Clifford. Milverton, Harriston and Palmerston have decided handsomely in its favor, and the other towns will likely do the same. Hydro is expected to be installed in December.

CANADIAN GOVERNMENT PURCHASING COMMISSION.

The following gentlemen constitute the Commission appointed to make all purchases under the Dominion $100,000,000 war appropriation:—George Gault, Winnipeg; Henry Laporte, Montreal; A. E. Kemp, Toronto. Thomas Hilliard is secretary, and the commission headquarters are at Ottawa.

General Industrial

Kerrobert, Sask.—The Federal Elevator Co. will build an elevator here. The contract has been let.

Montreal, Que. — The Consolidated Rubber Co. will make an extension to their factory on Notre Dame street.

London, Ont.—Beatty Bros., Ltd., will make an addition to their factory on York street at a cost of $3,000.

Port Arthur, Ont.—The Barnett & McQueen Co., contractors, have commenced work on the new National elevator.

Vancouver, B.C.—The W. H. Malkin Co., wholesale grocers of this city, are having plans prepared for the installation of up-to-date machinery for the manufacturing of their food products.

Victoria, B.C.—The Imperial Oil Co. bought five lots at Esquimalt, and has begun preliminary work for building an oil depot there. Storage facilities are to be erected and a wharf put up. A. M. Abbey represents the Imperial Oil Company.

The Cowan & Britton, Ltd., plant at Gananoque, Ont., manufacturing butts, hinges and other shelf hardware, established 54 years ago by C. E. Britton and the late O. D. Cowan, has been purchased by the Canada Steel Goods Co., Hamilton, Ont.

Winnipeg, Man.—The establishment of big pulp mills and a pickle factory on the line of the Greater Winnipeg Water District railway is proposed by Controller Midwinter. The controller outlined his plan at a meeting of the board held recently.

ALLIES PURCHASING AGENTS.

The Trade and Commerce Department, Ottawa, has published the following list of purchasing agents for military purposes for the allied Governments:—

International Purchasing Commission, India House, Kingsway, London, Eng.

French.—Hudson Bay Co., 56 McGill Street, Montreal; Captain Lafculloux, Hotel Brevort, New York: Direction de l'Intendance Ministere de la Guerre, Bordeaux, France; M. De la Chaume, 28 Broadway, Westminster, London.

Russian.—Messrs. S. Ruperti and Alexsieff, care Military Attache, Russian Embassy, Washington, D.C.

Municipal

Vernon, B.C.—The city council may install an auxiliary pumping station.

Sherbrooke, Que.—The city council have purchased a site for the new gas plant.

Owen Sound, Ont.—The council are considering the purchase of a motor hose wagon for the fire department.

Lindsay, Ont.—The Horn Bros' industrial by-law has been given the third reading by the council.

Port Rowan, Ont.—The installation of an electric lighting plant is contemplated by the town council.

St. John, N.B.—The city council are in the market for a quantity of cast iron pipe for water main extensions.

Stratford, Ont.—The town council contemplate purchasing about 1,800 feet of 6-in. cast iron pipe.

Athens, Ont.—The town council are considering installing an electric light and power plant.

Beauceville, Que.—The town council will call for tenders shortly on the construction of water-works, drainage and lighting systems. Engineer, F. Mignault, Sherbrooke, Que.

Toronto, Ont.—It is estimated that it will cost between four and five million dollars to rebuild the Morley avenue sewage disposal plant.

Collingwood, Ont.—A by-law will be submitted to the ratepayers to authorize a loan of $20,000 to the Bryan Mfg. Co. to rebuild their factory.

Sherbrooke, Que.—The Gas and Electric Committee have decided to purchase a motor truck from the Andover Motor Vehicle Co. at a cost of $1,860.

Tavistock, Ont.—J. G. Field has accepted an offer from the council of $3,000 for his electric light plant. Hydro power will be installed in the town.

Winnipeg, Man.—The city council contemplate extensions to the gas distribution system. A considerable quantity of cast iron pipe may be required.

Elmira, Ont.—The town council are considering the installation of a sewage system, estimated to cost $25,000. Engineer, H. J. Bowman, Berlin, Ont.

The Pas, Man.—The town council is considering the installation of a waterworks and sewage system, estimated to cost $80,000. H. H. Elliott, clerk.

Dorchester, Ont.—A by-law has been passed granting a franchise to the Southern Ontario Natural Gas Co., and permitting the laying of gas mains in the municipality.

Petrolia, Ont.—The power by-law and the one authorizing the raising of $35,000 for installing a hydro power plant were finally passed by the town council at a meeting held recently.

Chatham, Ont.—The Hydro-electric Commission has submitted a proposal to the city for using hydro power at the civic pumping plant. The scheme includes the purchase of two centrifugal pumps and motors. Total cost is estimated at $3,000.

Brockville, Ont.—The Light and Water Commissioners have instructed that plans and specifications for filtration and intake be sent to the Provincial Board of Health, Toronto. These are the plans made some time ago. It was also authorized that a new set of plans be prepared by G. Bryson, town engineer, and E. J. Philip, manager, covering the whole proposition for intake and filtration. The approval of the department will be sought as to the best method.

Contracts Awarded

Hamilton, Ont.—The Dominion Sheet Metal Co. have awarded the building contracts for their new factory.

Toronto, Ont.—Purdy, Mansell, Ltd., have been awarded a contract by the Board of Control for a steam pump.

A. R. C. Clark & Son, of St. John, N.B., have been awarded the contract for the construction of a sewerage system.

The Jenckes Machine Co., Sherbrooke, Que., will supply and erect a steel water tank for the town of Bedford, Que., at a cost of $4,675.

The Chatham Bridge Co., Chatham, Ont., have been awarded a contract for pumping machinery by the Chatham Township Council.

Brockville, Ont.—The Light and Water Commissioners have passed a resolution accepting the tender of the Donnelly Wrecking Co. for laying the intake under water for $4,973.

Toronto, Ont.—The Toronto Hydro-Electric Commission has awarded a contract for the supply of 1,000 feet of conductor cable at 42 cents a foot to the Eugene Phillips Electric Co. of Montreal.

Tenders

Ottawa, Ont.—The city council will proceed with the installation of an incinerator. Tenders are being received until Aug. 26. F. C. Askwith is city engineer, from whom particulars may be obtained.

Regina, Sask. — Tenders will be received by the City Commissioners up till Monday, September 6th, 1915, for the supply, delivery and erection of a 7,000,000 gallon pumping unit at the city power house. Specifications and other information may be obtained from J. M. MacKay, Superintendent of waterworks, Regina, Sask.

Toronto, Ont.—Tenders, addressed to the secretary-treasurer of the Board of Education, will be received until Tuesday, August 17, 1915, for all trades for enlargement of Eglinton Public School, also heat regulators and sundry trades in other schools. Specifications may be seen and all information obtained at the office of the superintendent of buildings, City Hall, Toronto.

Burlington, Ont.—Tenders will be received by the secretary of the Board of Water Commissioners until Monday, August 23rd, 1915, for the construction of a reinforced concrete gallery and connections thereto. Plan and specification may be seen at the office of the Water Commissioners, Burlington, or at the office of the engineers, Chipman & Power, Mail Building, Toronto.

WINNING THE BUYER'S FAVOR

THE best possible buyer is not made an actual buyer at a single step. It is one thing to win the buyer's favor for an article and another to make adjustments incident to closing the sale. Winning the buyer's favor is the work of trade paper advertising. Under ordinary conditions it should not be expected to do more.

Drumheller, Alta.—Tenders will be received up till Monday, August 16, 1915, for the following contracts: (1) Supply of about one mile of 6-in. and 4-in. steel or cast iron pipe; (2) valves and hydrants; (3) One return tube boiler and stack; (4) One duplex pump; (5) Materials for 30,000-gallon wood tank and housing; (6) All labor and certain materials for laying water mains, sinking an open well, constructing pumping station, and erecting wood tank and housing. Plans and specifications and other information may be obtained at the offices of the John Galt Engineering Co., Ltd., consulting engineers at Winnipeg and Calgary.

Personal

L. S. Hawkins, chief engineer of the Marconi Wireless Co., of Canada, is visiting Port Arthur, Ont.

David A. Thomas, representative of the British Government, and Gen. Mahon, ordnance expert, have been visiting the Maritime Provinces.

Sir Charles Ross, president of the Ross Rifle Co., Quebec, has been given the temporary rank of colonel in the Canadian militia, according to militia orders just issued.

R. O. McCulloch, secretary-treasurer of the Goldie and McCulloch Co., Ltd., Galt, Ont., has been appointed a director of the Union Bank of Canada.

C. H. Webster, formerly secretary of the Calgary Board of Trade, has been appointed secretary of the Western section of the Canadian Manufacturers' Association.

E. W. Knight, until recently with Frankel Bros., Toronto, has opened an office in the Stair Building, Bay street, Toronto, and will carry on a metal business.

Andrew Malcolm, president of the Andrew Malcolm Furniture Co., Kincardine, Ont., died at his home there on Aug. 9. The deceased was born at Killearn, Scotland, 75 years ago, and came to Canada in 1867, settling in Kincardine in 1874.

A. M. Mosley, who for the past few years has been manager of the National Tube Works at Fort William, Ont., has left for Guelph, Ont., where he will assume a similar executive position with the Page-Hersey Co., an affiliated concern.

C. E. Austin, general manager of the Moose Jaw Mills, Ltd., has been appointed general manager of the Dominion Government interior storage elevators between Fort William and Vancouver, with headquarters at Fort William, Ont.

Classified Advertisements

¶ Those who wish to sell or buy a business, obtain competent help, connect with satisfactory positions, or secure aid in starting new enterprises, should not fail to use the Want Ad. Page of "CANADIAN MACHINERY."

WANTED — EQUIPMENT FOR MACHINE (repair) shop; weight or accuracy not important as price. Give full details. Box 153, Canadian Machinery. (8)

TO THE USER OF WRENCHES

Users of Wrenches, both Pipe and Monkey Wrenches, will find economy in buying the Trimo makes. A new standard of quality has been set by Trimont Mfg. Company, the makers of these improved wrenches.

Be sure to ask for the Trimo Wrenches, both Pipe and Monkey, which are all-steel goods. They are equipped with Nut Guards that prevent the accidental turning of the adjusting nut in close quarters, and with Steel Frames, in the principal sizes that will not break.

These new Trimos are worth more to the user because of these improvements. Ask for the genuine and take no other. Don't let unfair dealers pass out the imitation on you. The name Trimo is on every Trimo tool.

Very truly yours,

TRIMONT MFG. COMPANY,

Roxbury, Mass.

CLEVELAND RIVETING, CHIPPING, CALKING AND BEADING HAMMERS

MOST POWERFUL AND EFFICIENT AIR TOOLS ON THE MARKET

Cleveland Riveters are made in 20 styles and sizes with driving capacities of ¼-in. to 1½-in. rivets in Boilers, Tanks, Stacks, etc.

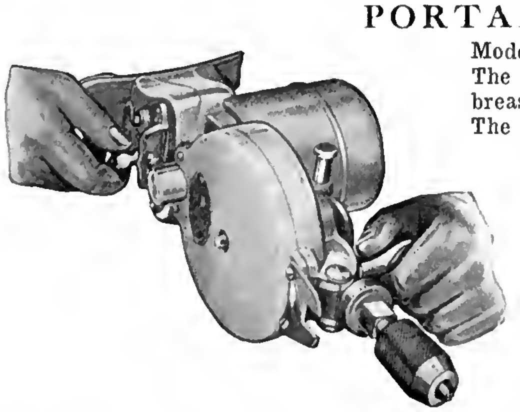
They have an enviable record for durability and economy in service.

CLEVELAND CHIPPING HAMMERS

are made in 20 styles and sizes to suit all classes of work. They are ideal tools for foundries, as they have high speed, no recoil and are practically dust-proof.

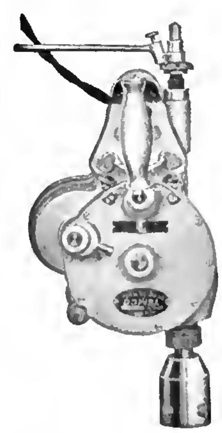
In stock: Riveting and Chipping Hammers, Air Drills, Corner Drills, Sand Rammers, Portable Grinders, Bowes Couplings, Chisels, Rivet Sets, etc.

PORTABLE ELECTRIC DRILLS



Model "B" Drill illustrated, shows compactness of design. The Casing, Switch and Gear Covers are aluminum; the breast plate, motor-head and handle supports are of steel. The machine is light in weight, convenient in shape; has high speed; operates on either A.C. or D.C. currents and runs either forward or reverse as desired. Model "C" has two speeds and in construction is similar to Model B.

Bulletins mailed on request.



Cleveland Pneumatic Tool Co. of Canada, Limited

80 Duchess Street, - Toronto, Ont.

Trade Gossip

Collingwood, Ont.—The Imperial Steel & Wire Co. have closed a large contract for wire and nails.

The Hamilton Bridge Works, Hamilton, Ont., will supply the steel work for the T. Eaton Co. factory.

Ottawa, Ont.—It is reported that the Government contemplate installing shoe machinery in the prison workrooms.

The Goldie & McCulloch Co., of Galt, Ont., have offered a gift of $5,000 to the Canadian Government for war purposes.

The Storey Pump and Equipment Co., New York, have been awarded a contract for pumps by the town of Stratford, Ont.

The International Engineering Works, Toronto, have sold a 12-6-12 in. outside end packed boiler feed pump for the Toronto Island filtration plant.

The Canadian Sarco Engineering Co., Winnipeg, has been awarded a contract by the municipality of Assiniboia, Man., for the supply of 193 Chapman gate valves at $3,500.

St. Andrews, N.B.—The sardine factory at Chamcook, four miles from St. Andrews, has resumed operations after having been closed for the last year. Recently the entire plant and equipment were purchased by the Lane-Libby Fisheries Co., of Boston, Mass.

T. MacAvity & Sons of St. John, N.B., have offered to place at the disposal of the War Office the site and preliminary work on a new plant on Marsh road, on which $10,000 has already been expended. D. A. Thomas, to whom the offer was made, has the matter under consideration.

Orillia, Ont.—The Orillia smelter has begun the treatment of molybdenum. This rare metal is used for hardening steel in connection with the manufacture of guns and other armament. The ore, which is a substitute for nickel, is found in Renfrew County, but it has not been treated in Canada previously.

The Toronto Hydro-Electric Commission has decided that $1,300,000 would have to be provided to carry on necessary extensions and liquidate some of the accounts owing the city. It was pointed out that money would be required to place the Interurban system, recently taken over, in a satisfactory condition.

Canadian Car & Foundry Contract.—The New York Journal of Commerce reports that the Canadian Car & Foundry Co., which early this year received a contract, valued at $83,000,000 from the Russian Government calling for a large

As additional machine tools are installed, new power transmission machinery looms up as important.

The AMERICAN PULLEY COMPANY maintains a constant stock of steel-split pulleys—50,000 of them—for immediate shipment. Sizes from 3" to 72".

These pulleys are 20-year-old successes, and over 2¼ million have been marketed.

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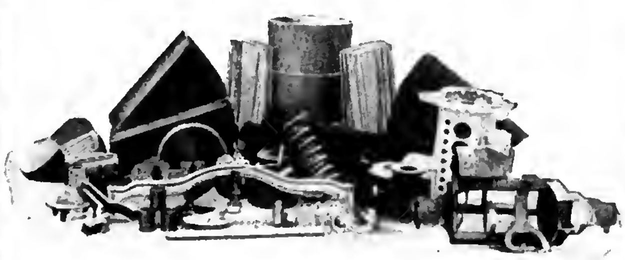
Including Steel, Aluminum, Cast Iron, Malleable Iron, Brass, Copper and Sheet Steel that have been



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With our welding outfits on the job, you will increase the productiveness of your plant and save many an expensive machine part from the scrap heap.

The Approximate Cost of Oxy-Acetylene Welding:
Oxygen at 3 cents per cubic foot—
Acetylene at 1 cent per cubic foot—
nothing as compared with service rendered.

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In Anaconda you have greater belting efficiency service and economy for your money than in any other belting of any kind.

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quantity of shrapnel and high explosive shells, has had the original order raised to the sum of $154,000,000.

C.P.R. Taking Over Allan Line.—The C.P.R. Company is taking over the Allan Line steamship business, beginning October 1, this year, a new corporation having been organized in Montreal for this purpose under the name of the Canadian Pacific Steamships, Limited. George M. Bosworth, vice-president of the C.P.R. Company, is the president of the newly-formed Canadian Pacific Steamships, Limited, and H. Maitland Kersey is to be the managing director, with his office in London, England. The new company is to take over all the ocean steamships now operated by the C.P.R. Company and the Allan Line, and the head office will be in Montreal. Messrs. G. M. Bosworth, I. G. Ogden, E. W. Beatty, K.C., vice-president of the C.P.R. Company, and F. E. Meredith, K.C., were the directors in attendance at the organization meeting.

Book Reviews

"The Coking of Coal at Low Temperatures, with Special Reference to the Properties and Composition of the Products," by S. W. Parr and H. L. Olin, has been issued as Bulletin No. 79 of the Engineering Experiment Station of the University of Illinois. This report covers a series of studies made in continuation of the work on the coking of coal at low temperatures, described in Bulletin No. 60. Coke resulting from the low temperature process contains from 18 to 22 per cent. of volatile matter but retains none of the tar forming constituents. In domestic appliances it kindles readily and burns with a bright, smokeless flame. A suction gas-producer test made with this fuel compared favorably in ease of operation and efficiency with similar tests of anthracite. The tar has a specific gravity of 1.069, contains less than 2 per cent. of free carbon and is rich in low boiling substances, many of which are suitable for use in internal combustion engines. Its adaptability to wood preservation processes is shown by its high content of tar acids, which constitute nearly 30 per cent. of the crude material. The pitch residue amounts to 30 per cent. and is low in precipitated carbon. Naphthalene is absent. Results of these studies show that the coke, tar, and gas have specific properties of especial value, and indicate that the process of coking at low temperatures could be established successfully on a commercial basis. Copies of Bulletin No. 79 may be obtained gratis upon application to C. R. Richards, Acting Director of the Engineering Experiment Station, University of Illinois, Urbana, Ill.

Thread Milling Machines

For High Explosive Shells

Designed for the purpose of milling the thread in the base and nose of high explosive shells.

Shell is placed inside a revolving spindle and is self-centering. A perfect thread is produced in base of shell in approximately 2½ minutes.

Milling Cutter is made from best high-speed steel, by Brown & Sharpe, from special design by Holden-Morgan Co., and is so shaped that it can be sharpened without changing the form. Cutter is designed to mill the top of thread as well as the depth.

Machines are fully equipped for work, including oil pump. Fitted with automatic stop motion, which stops machine when thread is completed. One operator can run several machines. Eliminates all risk of having shells rejected on account of thread being stripped, as is liable to be the case when tapped by the old method.

Write for complete particulars, prices, etc.

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539 Richmond Street West, Toronto, Canada

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The A. R. Williams Machinery Company, Limited, Toronto, Ontario

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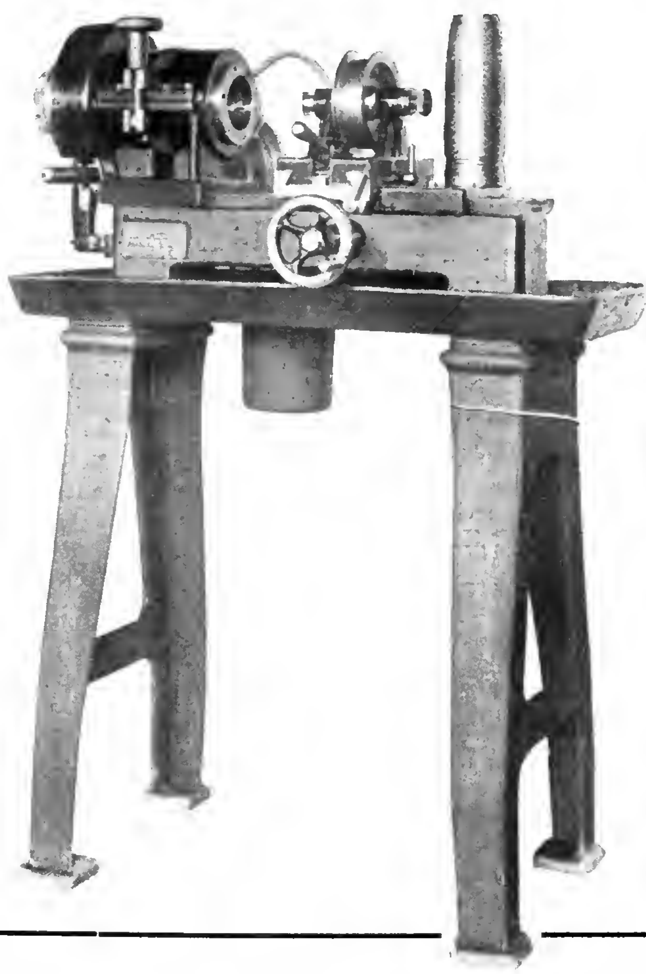
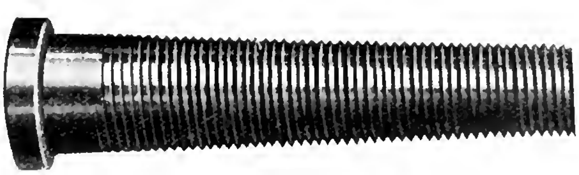


Taper Threading With a Geometric Die Head is a Simple Matter

The chasers follow the taper of the work automatically, and release the work at the end of the cut. Head is withdrawn without touching the finished threads.

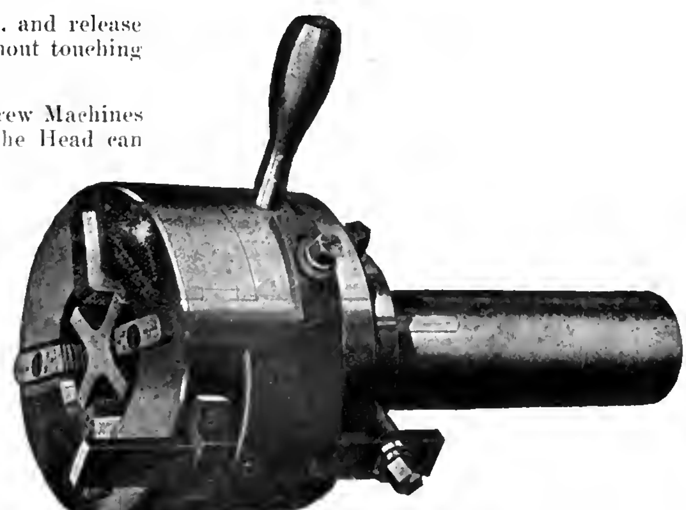
Geometric Taper Threading Die Heads are adapted to Screw Machines and Turret Lathes. When not cutting taper threads, the Head can be removed, leaving the machine free for other work.



Made to order, specially suited to requirements of machine and work.

Employed very generally at present on fuse work.

—Consult us about your taper threads—



A Geometric Taper Threading Die Head.

The Geometric Tool Company, New Haven, Conn., U.S.A.

Canadian Agents:

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If what you want is not advertised in this issue consult the Buyers' Directory at the back.

& Co., of Oshawa. The new building, which will be of fireproof construction, will cost about $30,000 equipped, and work will be commenced at once.

Contracts Awarded

St. John, N.B.—Vroon & Arnold, of this city have been awarded the contract for a quantity of cast iron pipe of various sizes.
tion have awarded a contract to the Dominion Radiation Co., Toronto, for heating and ventilating the new public school. The cost will be $2,527.

Chambly Basin, Que.—The town council have awarded the contract for laying sewer and steel pipe and installing pumps to S. W. Hamilton of Montreal.

Brockville, Ont.—The city council has awarded the contract of $4,600 for the laying of 800 feet of intake pipe to the Donnelly Wrecking Co., Ogdensburg, N.Y.

Montreal, Que.—The Phoenix Bridge and Iron Works, Ltd., have secured the contract for the extension to the Harrison Co. bakery, at Westmount. The new building will be three storeys high, 265 x 140 feet and will cost $200,000.

Collingwood, Ont.—It is announced that the Imperial Steel & Wire Co., will re-open their plant about the end of August. The company has recently booked a large export order for wire and wire nails.

Tenders

St. Hilaire, Que.—The town council are calling tenders for the construction of an electric lighting system.

Ottawa, Ont.—The city council will proceed with the installation of an incinerator. Tenders are being received until Aug. 26. F. C. Askwith is city engineer, from whom particulars may be obtained.

Toronto, Ont.—Tenders will be received by the chairman of the Toronto Electric Commissioners up to Thursday, Aug. 26, for an overhead traveling crane. Specification and form of tender may be obtained from the office of the purchasing agent, 15 Wilton ave., Toronto.

Regina, Sask.—Tenders will be received by the City Commissioners up till Monday, September 6th, 1915, for the supply, delivery and erection of a 7,000,000 gallon pumping unit at the city power house. Specifications and other information may be obtained from J. M. MacKay, Superintendent of waterworks, Regina, Sask.

Burlington, Ont.—Tenders will be received by the secretary of the Board of Water Commissioners until Monday, August 23rd, 1915, for the construction of a reinforced concrete gallery and connections thereto. Plan and specification may be seen at the office of the Water Commissioners, Burlington, or at the office of the engineers, Chipman & Power, Mail Building, Toronto.

Ottawa, Ont.—Tenders will be received until Wednesday, September 1st, 1915, for the manufacture, delivery of, construction and erection complete of sluice pipes, valves, operating machinery and electrical equipment for Swift Rapids Dam, Trent Canal. Plans, specifications and forms of tender can be obtained by application to the chief engineer, Department of Railways and Canals, Ottawa, or to superintending engineer of the Trent Canal, Peterboro, Ont.

Thorold, Ont.—Tenders will be received by the town clerk until Wednesday, August 25th, 1915, for the construction of a system of sanitary sewers in St. Andrews Ward, comprising about 14,225 lineal feet of pipe laying; also for the construction of sewage pumping station. Machinery to be furnished and installed by corporation. Plans and specifications may be seen at the resident engineer's office, Thorold, or at the office of the chief engineers Chipman & Power, Mail Building, Toronto.

Wood-Working

Northland, Ont.—James Bryant's saw mill was destroyed by fire recently.

Kingston, Ont.—S. Anglin & Co. will build a planing mill at a cost of $4,000.

Kingston, Ont.—S. Anglin & Co., are building a planing and sawmill to cost $4,000.

Makamik, Que.—The Makamik Sawmill Co., is building a sawmill to cost $6,000.

Montreal, Que.—The S. & A. Brochin Co., are in the market for woodworking machinery.

Bury, Que.—L. H. Martin's sawmill has been destroyed by fire, with a loss of $8,000, including machinery.

North Bay, Ont.—The Gordon Lumber Co. saw mill has been destroyed by fire. The loss is estimated at $150,000 about half of which is covered by insurance.

Sydenham, Ont.—It is reported that H. M. Woodruff has sold his mill to a Renfrew syndicate, who will convert it into a power plant and also build a sash and door factory.

Milton, N.S.—Fire breaking out in the lumber mill and box factory of the McLeod Pulp Co. destroyed both buildings and a large amount of machinery on July 27. The loss is estimated at something over $10,000 with some insurance.

Personal

Charles F. Gray, of Winnipeg, has been appointed manager of the Watrous Electric Light Co., in succession to W. E. Thorneloe, resigned.

T. A. Kerr, formerly of the Sudbury Construction and Machinery Co., has been appointed general manager of the Nipissing Foundry Co., North Bay, Ont.

Robert Bowie, vice-president of the Canada Foundries & Forgings, Ltd., died at Brockville, Ont., on August 13. The late Mr. Bowie was born in London, England, on March 3, 1840.

H. B. VanEvery, Power Building, Craig st., Montreal, has been appointed Canadian representative of the S. Morgan Smith Co., of York, Pa., manufacturers of hydraulic turbines.

D. A. Thomas, representative in Canada of the Minister of Munitions, has returned to Ottawa from New York, and the Shell Committee and Mr. Thomas' party expect to leave this week to visit shell plants in Ontario and the West.

Louis Charlton Fritch has been appointed general manager of the C. N. R. lines east of Port Arthur, Ont., with headquarters at Toronto. Mr. Fritch, who has been assistant to the president of the railway since March, 1914, was born in 1868 at Springfield, Ill.

George Henderson, son of the late Joseph R. Henderson, succeeds his father as president and general manager of the Brandram-Henderson Company. The new president has been a director for some years, and has had charge of the Maritime end of the business. At the time of his father's death he was preparing to go to the front with the overseas expedition.

New Incorporations

The Sardis Shingle Co., Vancouver, B.C., has been incorporated with a capital stock of $10,000.

The Cleaning Compound Co., Victoria, B.C., with a capital stock of $50,000 has been incorporated to manufacture cleaning articles, etc.

The Crescent Valley Lumber Co., Vancouver, B.C., has been incorporated with

Steel for Shells!

PROMPT SHIPMENT

Billets and rounds of suitable physical and chemical specification for forging and turning into shrapnel cases and lyddite shells of any size.

LACKAWANNA STEEL COMPANY

Standard structural shapes,
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Sheared and universal mill plates,
Sheet bars, and Lackawanna
Sheet Steel Piling.

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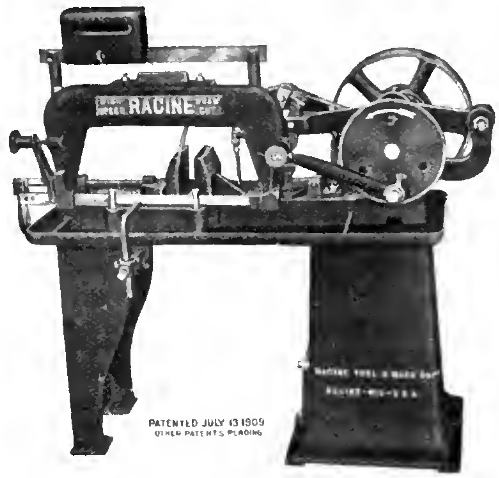

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The Newly Improved Racine High Speed, Metal-Cutting Machine?

FOR MANY GOOD REASONS—among others—because for speed, accuracy, economy and ease of operation THE RACINE cannot be surpassed. You MAY NEED ONE NOW. We will send a RACINE on any trial basis that is fair. WRITE US or any good Canadian dealer.

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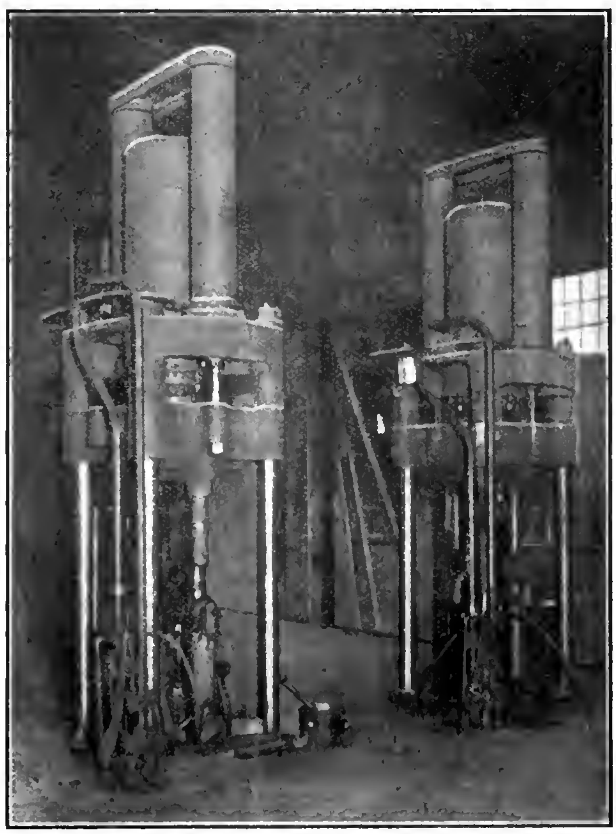

a capital stock of $25,000 to manufacture timber, etc.

The Keystone Logging & Mercantile Co., Silverdale, B.C., has been incorporated with a capital stock of $10,000 to manufacture lumber, shingles, etc.

The Burbank Motor Co., Kelowna, B.C., has been incorporated with a capital stock of $15,000 to manufacture automobiles, agricultural implements, etc.

McFee, Henry & McDonald, Ltd., Victoria, B.C., has been incorporated with a capital stock of $50,000 to manufacture drills, drilling machinery and other implements, etc.

The Rosetown Electric Light & Power Co., Rosetown, Sask., has been incorporated with a capital stock of $50,000 to erect plants and generate electricity, light, heat, power, etc.

The R. M. Moore & Co., Vancouver, B.C., has been incorporated with a capital stock of $50,000 by Robert M. Moore and others of Vancouver to manufacture engines, lighting, heating and power machinery, etc.

The Montreal Leather Goods Co. has been incorporated at Ottawa with a capital of $50,000 to make leather goods and machinery at Montreal. Incorporators: A. Papineau Mathieu, Armand Mathieu and Robert T. Mullin, all of Montreal.

C. A. Spencer, Ltd., has been incorporated at Ottawa with a capital of $150,000 to carry on business as contractors at Montreal. Incorporators: A. Huntley Duff, Walter A. Merrill and Phillippe Marchant, all of Montreal.

The Georgian Bay Coal Co., has been incorporated at Ottawa, with a capital of $100,000 to operate and develop mining properties. Head office is at Toronto and the incorporators are Robert Charles Vaughan, Lorne William Mitchell, of Toronto, Ont.

Montreal Motor, Ltd., has been incorporated at Ottawa with a capital of $75,000 to manufacture all kinds of steel goods, projectiles, ammunition and gun carriages, etc., at Montreal. Incorporators: Samuel Bruce Holmes and Edward Charles Baker, all of Montreal.

The George Frid Brick Co. has been incorporated at Toronto with a capital of $40,000 to carry on business as contractors and brick makers at Hamilton, Ont. Incorporators: John Edward Frid, J. A. Forrest and Robert B. Cheyne, all of Hamilton, Ont.

The Canadian Metal Cap and Seal Co. has been incorporated at Ottawa with a capital of $600,000 to manufacture the "Spengler" bottle cap and similar products at Montreal. Incorporators: Leslie H. Boyd, A. R. Johnson and Arthur Ross, all of Montreal.

The Ideal Canning Co. has been incorporated at Ottawa with a capital of $50,000 to carry on a canning business at St. Dorothee, Que. Incorporators: Joseph E. Decelles, Joseph N. Decarie and P. A. Decarie, all of Montreal, Que.

Hubert Villeneuve, Ltd., has been incorporated at Ottawa with a capital of $50,000 to carry on business as contractors, with head office at Montreal. Incorporators: Hubert Villeneuve, J. E. Carpentier and W. J. B. Johnston, all of Montreal. P.Q.

The United Engine & Separator Co., Ltd., has been incorporated at Ottawa to take over the business of the United Engine Co., of Toronto, Ont. The company is capitalized at $50,000 and the incorporators are Robert B. Gardner, Charles E. Lillie and Jeremiah Skelton, all of Toronto.

Trade Gossip

The Nova Scotia Steel & Coal Co. has given four machine guns to the Government for the Canadian expeditionary forces. Officers and clerks of the company at the Sydney mines have promised another.

Ottawa, Ont.—The Ottawa Board of Control at its next meeting will consider the advisability of assisting the Empire in this war by making a grant towards the establishment of a shell factory to sell to the Government at cost, and will later take the matter up with the Shell Committee.

Windsor, Ont.—Secretary Ray, of the Board of Trade, is in receipt of an inquiry from a manufacturing firm in Ohio desirous of establishing a Canadian branch. A building of 5,000 or 10,000 feet of floor space would be suitable, if located on railway switch. The secretary would be glad to hear from anyone who has such a building to offer.

John Bertram & Sons and Pratt & Whitney Co., of Dundas, Ont., and their employees have decided to donate ten machine guns to the Government for the use of Canadian soldiers at the front. A meeting of the employees of both firms was held on Aug. 6 and it was decided that each employee would donate two days' pay and the firms would make up the balance.

St. John, N.B. — New Brunswick Metals, Ltd., a new company, has been organized with an authorized capitalization of $98,000 to operate the antimony

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The Base Tank and Large Gear Pump is the latest addition to its many advantages. Tank holds 20 gallons of cutting lubricant.

Pump never requires priming and will deliver ten gallons per minute to the cutters, keeping them cool when run at very high speed.

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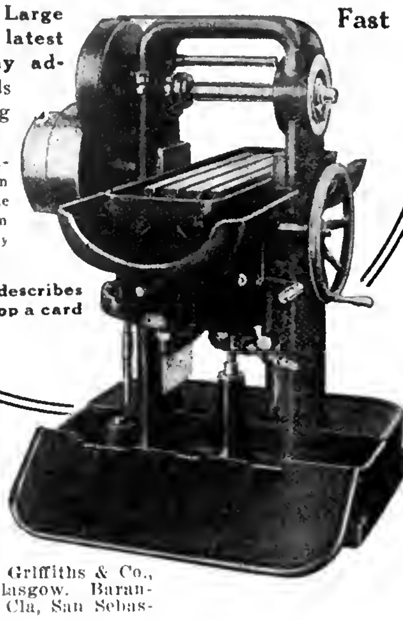

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for steel and steel alloys.

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for cast iron, brass, bronze, etc.

This substance is also a product of the electric furnace and finds a wide range of utility in the manufacturing field where materials of less brittleness than steel are to be ground.

Norton ALUNDUM and CRYSTOLON Grinding Wheels will help solve your grinding problems.

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780

mines at Lake George, 25 miles from Fredericton, J. A. DeCew, chemical engineer of Montreal backed by English capital, is at the head of the enterprise. Arrangements are being made for the operation of the mine on an extensive scale.

St. John, N.B.—The government of New Brunswick, impressed with the necessity of conserving the economic resources of the province, has in view the projection of a scheme of reforestation. As a step in this direction, a classification of the Crown lands has been entered upon. Premier Clarke and Hon. J. D. Landry have been in Quebec lately looking into the plan of reforestation adopted by the government of that province.

Shell Committee Visit Plants.—Members of the Shell Committee and of the party accompanying D. A. Thomas, Lloyd George's agent of munitions in Canada, have returned to Ottawa from their visit to Montreal and the Maritime Provinces, where they inspected factories which are turning out shells. The party will leave in a few days to visit factories in Ontario and the West. They expressed themselves as well satisfied with the manner in which Canadian manufacturers are responding to the call for munitions.

Nickel Output of Canada.—The output of copper-nickel matte in Canada in 1914 was 46,396 gross tons, valued by the producers at the smelter at $7,189,031. It contained 28,895,825 lb. of copper and 45,517,937 lb. of nickel. The ore tonnage smelted was 947,053. The production in 1913 was 47,150 tons of matte containing 25,875,546 lb. of copper and 49,676,772 lb. of nickel. An increase was thus shown in copper content and a decrease in nickel. The world's production of fine nickel in 1913 approximated 34,000 tons, of which the Canadian ore contained 24,838 tons.

Butterfield & Co.—Work has commenced on the new plant of the Butterfield & Co., Rock Island, Que., branch of the Union Twist Drill Co. of Athol, Mass. There will be two buildings, the first 185 feet by 60 feet, three storeys; the second 175 feet by 60 feet, one storey. The new plant will be devoted to the manufacture of the complete line of twist drills and milling cutters which have hitherto not been made in Canada. The present tap and die factory of Butterfield & Co. will be transferred into the new building and the old building probably used for storage and warehouse purposes. The buildings are to be of reinforced concrete construction and it is expected that they will be completed and in operation by December next.

Vancouver, B.C.—As the result of negotiations which have been progressing for the past month with respect to the property and plant of the Ocean Falls, Ltd., the well known pulp and sawmills of this province, a new company has been formed to take over the plant and all the assets of the former company, and to erect a paper mill for the manufacture of that commodity in addition to pulp. The name of the new company is the Pacific Mills, Ltd., in which the Crown-Willamette Paper Co., of Portland and San Francisco are the parties most heavily interested. The new company is capitalized at $9,-500,000. J. H. Lawson, jr., of Vancouver, is to be president of the new concern and W. S. Lane is secretary. The directors are Messrs. N. R. Lang, S. D. Brooks, W. S. Lane, R . R. Parker, and J. H. Lawson, jr., all of Vancouver.

Catalogues

Wood Split Pulleys made by the Oneida Steel Pulley Co., Oneida, N. Y., are described fully in catalogue No. 6. Tables giving prices and shipping weights of the various sizes are included.

Flexible Shafts.—Bulletin No. 54 is devoted to a description of the combinations of "Stow" flexible shaft and electric motor. Particulars are given of the suspended type, of a general utility tool and of a two-spindle drill accompanied by illustrations.

Turbo-Generators.—The many advantages of the turbo-generator in small and moderate sizes are set forth in detail in Bulletin No. 54, just issued by the Kerr Turbine Co., Wellsville, N.Y. Many interesting installations of "Economy" turbo-generators are also described and illustrated. Copies will be mailed upon request.

"Shaw" Compression Couplings are described in a bulletin issued by the Keystone Pulley Co., Oneida, N. Y., who are exclusive agents for this line. The bulletin deals with both the single and double compression flange couplings, and contains tables giving prices and principal dimensions for the various sizes.

Metals.

The feature of the market this week is the continued decline in prices notwithstanding that conditions have changed very little. The inference is that prices are gradually reaching their proper level and that the previous inflated quotations have been due partly to manipulation and also on account of unsettled conditions due to the war. Copper, tin, spelter, and lead are all lower, while antimony, although unchanged is very easy. All solders have declined approximately ½c per pound on account of the weakness in the tin market. The general situation is practically unchanged there being a good demand for metals for munitions.

Tin.—The market is stagnant there being little inquiry for any position with the exception of a few inquiries for early delivery. Tin has declined 1c and is being quoted locally at 39c per pound.

Copper.—The International situation is depressing the market which is dull and weaker. There is very little business moving, both buyers and sellers awaiting political developments. The market has declined 1c locally and Lake copper is now quoted at 19c per pound.

Spelter.—The market is gradually getting into a more normal condition, the recent abnormal prices being the result of speculation. The demand is improving to some extent but the market has declined 4c and quotations are nominal at 16c per pound.

Lead.—The London market is improving slowly but New York is quiet and lower. The "Trust" price is being maintained at $4.50 New York, but sales are being made under that figure. Lead is quoted locally at 6c per pound representing a decline of ½c.

Antimony.—The market is stagnant and an entirely nominal one with a weaker undertone. Quotations are unchanged at 40c. per pound.

Aluminum.—The market is unchanged and quotations entirely nominal at 40c per pound.

CANADA'S DEBT.

THE financial statement of the Dominion to August 1 shows some striking increases in liabilities as compared with the same date last year. In the twelve months there has been an increase in temporary loans of $92,000,000, of $13,000,000 in the net debt, and of $16,000,000 in Dominion notes outstanding. The total gross debt of the Dominion in August 1 was $734,656,544, of which $362,703,312 was payable in London.

Temporary loans included amount to $100,673,684, and Dominion notes outstanding $152,043,872, an increase of $16,111,396 over last year. The total net debt on July 31 was $463,745,092, an increase of $13,457,371 for July.

Customs, excise and post office alike show an increasing revenue for July as compared with July last year. The figures are:

	July, 1914.	July, 1915.
Customs	$6,807,058	$7,240,321
Excise	1,653,050	1,734,477
Post Office	825,000	1,200,000
Public works, including railways	1,678,298	1,152,374
Miscellaneous ..	1,558,215	1,327,917
Total	$12,521,624	$12,655,085

Total revenue for the first four months of the fiscal year was $29,371,327, as against $32,704,870 for the corresponding period last year. July expenditure on capital account (for permanent works) was $3,920,518, of which $3,808,273 was on public works, including railways and canals, and $112,245 for railway subsidies.

The statement does not show war expenditure separately, but the increase in temporary loans is understood to be chiefly accounted for under this head. War expenditure is now averaging approximately $10,000,000 a month.

ALLIES' PURCHASING AGENTS.

The Trade and Commerce Department, Ottawa, has published the following list of purchasing agents for military purposes for the allied Governments:—

International Purchasing Commission, India House, Kingsway, London, Eng.

French.—Hudson Bay Co., 56 McGill Street, Montreal; Captain Lafoulloux, Hotel Brevort, New York; Direction de l'Intendance Ministere de la Guerre, Bordeaux, France; M. De la Chaume, 28 Broadway, Westminster, London.

Russian.—Messrs. S. Ruperti and Alexsieff, care Military Attache, Russian Embassy, Washington, D.C.

THE WORLD'S ZINC SUPPLIES.

THE Financial Times of July 26 contains the following notes on zinc, compiled by Rudolf Wolff Kreuger & Co.:—

"We compile statistics every year of the production of virgin and secondary spelters; the last available statistics that we have before us are those for 1913, because, naturally, for 1914, after five months of the great European war, no enemy returns were available. Examining our figures for 1913 we find the total European output was 661,325 tons. Australia gave us 3,666 tons and the United States 508,549 tons. Out of the European total we must now cancel the Belgian, Silesian, Rhenish, Northern French, Austrian and Polish productions; these amount together to 570,152 tons per annum. It, therefore, follows that the onus of supplying the allies with spelter falls upon the United Kingdom, Holland, Spain, Australia and the United States.

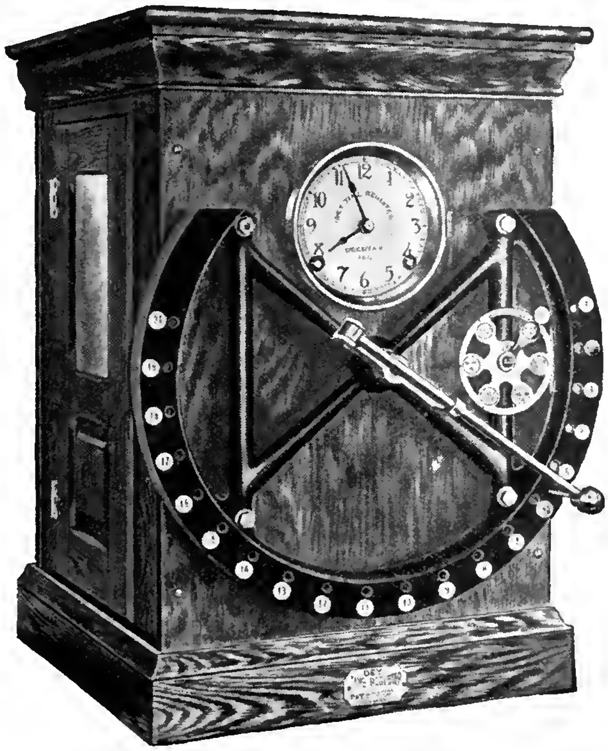
Our own producers have probably slightly increased their output during the present year, but owing to the shortage of labor and the lack of furnace capacity we have not made anything like the advance that we should have done. The Dutch production has certainly fallen off, owing to the extreme difficulty of getting the ores into Holland. (Holland itself produces no zinc ores.) The Spanish production most likely remains unchanged. Australia has undoubtedly developed, and may send us 1,000 to 1,500 tons more this year. To make up for the bulk of the shortage, we have to look to the United States of America. In this respect it is, therefore, interesting to study the figures compiled by the United States Geological Survey. These statistics have already been considered very reliable, and when it is intimated, therefore, that the United States of America during 1915 may be in a position to furnish about 560,000 tons of spelter, this is interesting, as it provides for an increase on their 1913 total of something like 250,000 tons.

War Consumption of Spelter.

"Were the consumption of spelter to take normal course, even this increase on the part of the United States of America would not be sufficient to meet all demands. The price of spelter, however, has risen now to a level, which practically precludes any consumption save that for war purposes. This is a state of affairs which we forecast in many of our previous reports; that it was distasteful to those consumers, who were going to be squeezed out of business, we fully understand, but it was a situation that had to be faced. The requirements of the European war upon spelter are monthly increasing, and it is to be anticipated that consumption for war purposes will grow larger and larger. We think, however, that the smelting capacity among the allies and neutral countries will also increase, and with all normal peace trade suppressed, the equilibrium between supply and demand will be found again.

"Much has also been written about the German control of the vast zinciferous resources of our colonies. Most of the observations made upon this subject we entirely concur with; we have often made allusion to the same thing before, and we think it is pitiable to find a situa-

Here are "3 buys" that run into thousands of dollars



A splendid machine—costs only $85.

Raw Materials
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Raw materials are checked, counter-checked and tested. You know what you're getting.

You carefully check the machinery buys—you get guarantees. It would be hard to beat you on these purchases.

Now, the Labor. Ah! the biggest daily buy you make. How do you check IT? Do you get every minute you pay for? Haven't you a right to?

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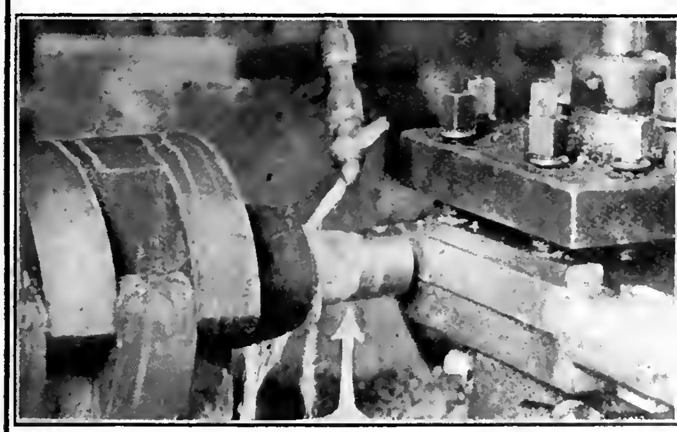

ECONOMIC WATER OIL

SHELL MANUFACTURERS use ECONOMIC WATER OIL for METAL CUTTING of every description; it will not gum nor rust, and it SAVES TIME AND LABOR.

WE CAN SAVE YOU 50% in the **COST** of your **CUTTING MIXTURE** BECAUSE

ONE GALLON of ECONOMIC WATER OIL will mix readily with **30 to 50** gallons of WATER, making a thick, creamy emulsion, and giving you a cutting mixture which will not only be **satisfactory**, but will produce very **ECONOMIC RESULTS.**

One TRIAL ORDER will prove our STATEMENT.

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CANADIAN ECONOMIC LUBRICANT CO.
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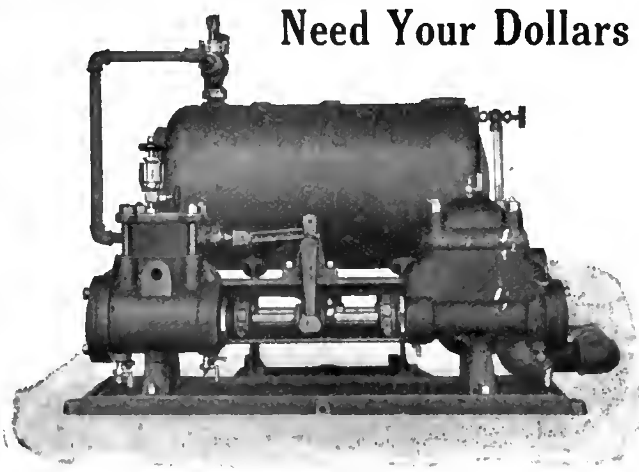
You need the best PUMP on the market

Canadian Workmen Need Your Dollars



Fill these needs by placing your order with

THE SMART-TURNER MACHINE CO.
LIMITED
Hamilton, Canada

If what you want is not advertised in this issue consult the Buyers' Directory at the back.

tion created like the present one, owing to the fact that German houses have been always able to contract for our output of colonial concentrates to the detriment of the British buyer.

Present Situation Summary.

"Our summary of the whole position is this: The spelter market may have been, and probably has been to a certain extent, exploited, but the situation at which we have arrived was inevitable, when German houses established the control of the British zinciferous reserves, and made full arrangements for treating the same. We consume alone in the United Kingdom something between 170,000 and 200,000 tons of spelter per annum, and we actually produce about 60,000 tons. At all events, it is satisfactory to know that Lloyd George's recent action has removed any likelihood of a shortage in the large supply needed for munitions."

CANADIAN TRADE SHOWS INCREASE.

THE total Canadian trade for July reached $100,000,000, according to the statement now issued by the Hon. J. D. Reid, Minister of Customs. For the corresponding month of 1914 the total trade amounted to $93,000,000.

The feature of the statement is the large increase in domestic and foreign exports. During the month of July, domestic exports reached $45,600,000 and foreign goods exported from Canada $16,000,000, compared with $41,000,000 domestic and $8,000,000 foreign for the corresponding month of 1914. Eleven million dollars worth of animals and their product was exported during July, being a substantial increase over the corresponding month last year. Manufactured goods also show a good increase, the exports being $12,500,000, against $5,800,000 for July, 1914.

While the exports are soaring, there is a decrease in the merchandise entered for consumption. During July $36,000,000 worth of goods were imported, made up of $20,000,000 dutiable and $15,000,000 free goods. This is a falling off for the corresponding month of 1914, when the imports amounted to $42,000,000, made up of $26,000,000 dutiable and $16,000,000 free goods.

For the four months of the present fiscal year, ending July 31st last, the total Canadian trade was $371,000,000, compared with $306,000,000 for the four months of the corresponding period last year. Last July $13,000,000 worth of corn and bullion was exported.

Truro, N.S—The plant of the Truro Engineering Works has been purchased by the Truro Steel Co.

Stott & Hamilton, of St. Thomas, have been awarded the contract for installing a low pressure steam system for heating the public school at Belmont, Ont.

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IS THE IDEAL TEST FOR TAPS

They have got to be made right and tempered right to stand up to the job on shell metal.

Butterfield Taps

are just in their element on shell work or any other job where fast cutting on tough materials is required.

They produce more work in a given time and last longer. We know it because we have put them to many working tests against other makes.

Positively Guaranteed.

MADE IN CANADA

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INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Toronto, Ont.—The Russell Motor Car Co., have been given an order for shells.

New Glasgow, N.S.—McNeil Brothers, will spend $75,000 on equipment for its plant.

Goderich, Ont.—The Doty Engine Co. are about to purchase machinery for making shells.

Renfrew, Ont.—A building will be erected by Mr. Low, of this town, to be used for the manufacture of shells.

Cowansville, Que.—The Norwood Engineering Co. is erecting a plant for the manufacture of shells and ammunition.

Deseronto, Ont.—It is reported that a syndicate has purchased a site here and propose establishing a plant for making shells.

Toronto, Ont.—The Bawden Machine Co. have obtained a permit for the erection of an addition to their shop, to cost $2,500.

Fort William, Ont.—It is reported that the old Zenith zinc mine at Nipigon Bay will be opened again for active mining operations.

Halifax, N.S.—The Imperial Oil Co. may establish an asphalt and fuel oil refinery here. The company expect to spend $400,000.

St. Catharines, Ont.—The Whitman & Barnes Mfg. Co. will soon begin work on an addition to its plant for the manufacture of tools.

Smith's Falls, Ont.—The Frost & Wood Co. will install $35,000 worth of machinery in its plant for the manufacture of shells, etc.

Bridgeburg, Ont.—It is announced that the King Separator Co., of Buffalo, N.Y., will establish a plant here for assembling parts of their Canadian product.

Kincardine, Ont.—The Hunter Bridge & Boiler Co. expect to commence work on the manufacture of shells for the British Government in the course of a few weeks.

Edmonton, Alta.—G. W. Farrell, of Montreal, is interested in a scheme to develop hydro-electric power at a point on the North Saskatchewan River, near Rocky Rapids, about 60 miles from here.

Hamilton, Ont.—It is reported that the Garland Stove Works have received an order for 500,000 high explosive shells from the French government.

Quebec, Que.—Tenders will be called shortly by the Quebec Streams Commission for the damming of the St. Francis River at a point in the neighborhood of Disraeli, Co. Wolfe, on the Quebec Central Railway. The cost of the work is estimated at $350,000.

Kingston, Ont.—The Canadian Fire Underwriters' Association have recommended that the capacity of the pumping plant be increased, a new boiler purchased for the pumps, and the water main be renewed between the pumping station and standpipe.

New Hamburg, Ont.—On August 20 a fire broke out in the plant of the Electric Meteor and Stamping Metal Co., and the entire building and contents were destroyed. The factory was managed by John Messner and employed about 75 hands. The loss is estimated between $30,000 and $40,000, partly covered by insurance.

Edmonds, B.C.—Plans and specifications have been submitted to the Burnaby Council by the Shell Oil Co., for the building of a plant here. The plans, which entail an expenditure of $110,000, call for the erection of wharfage, crib work, warehouses and several steel tanks having a capacity ranging from 5,000 gallons to 38,000 gallons.

Electrical

Berlin, Ont.—The Light Commission will purchase a number of 25-cycle motors to replace 60-cycle machines.

Listowel, Ont.—Vote is to be taken on August 21st, on a by-law authorizing the installation of a hydro-electric system at a cost of $6,600.

Welland, Ont.—The Hydro-Electric Commission propose to spend $8,000 on a transmission line and transformer at the Weedon Mining Co. plant.

Southampton, Ont.—A by-law providing for the installation of a hydro-electric system at an approximate cost of $13,000 will be submitted shortly.

Lambton, Ont.—Work has been commenced on the erection of a new electric sub-station in Lambton Park by the Toronto Suburban Railway Company.

Thistletown, Ont.—A movement is on foot in the village for the linking up of Thistletown with the hydro-electric system. At present the village is served by a private power concern, which, besides providing some street lights, does a considerable business with the local consumers.

Toronto, Ont.—The Toronto Hydro-Electric Board have applied for the passage of a by-law by the City Council to raise $1,375,000 for new work. The items of the work are given as follows: Sub-feeders and feeders generally, east end station, construction and equipment, additional equipment for direct current supply in downtown district, increased general capacity of station and pole type transformers, additional services and meters, general line extensions, Sterling Road transformer house and equipment, additional requirements for civic car line service, towers to cross new channel for Ashbridge's Bay development and to complete the loop circuit to the Island, and general extensions and improvements as required to meet the general development of the business as required.

Municipal

Victoria, B.C.—The City Council are contemplating the installation of a civic abattoir to cost $20,000.

Liverpool, N.S.—A by-law has been carried to authorize an expenditure of $10,000 on repairs to the electric plant.

Weyburn, Sask.—Work is in progress on the construction of the $15,000 sewage disposal plant here. Engineer, George Reed.

Meaford, Ont.—The ratepayers on August 15 turned down the by-law to sanction improvements to the waterworks system.

Berlin, Ont.—An extension to the sewage disposal plant is under consideration. Chipman & Power, of Toronto, are the engineers.

Welland, Ont.—A by-law will be prepared and placed before the Town Council to fix an assessment of $5,000 for the Weedon Mining Co., who propose establishing a zinc smelter here.

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COVERS THE CONTINENT

JOHNS-MANVILLE SERVICE TO THE MANUFACTURER

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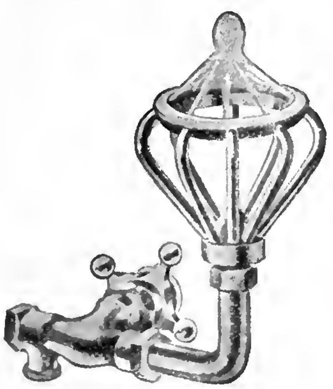
J-M Sanitor Drinking Fountain eliminates the contaminations of Bubble Jet as well as those of Public Cup.



The J-M Sanitor Drinking Fountain Head forms a jet of water with eight small streams opposed annularly. All waste water falls within the ring, and does not come in contact with the supply orifice. Contamination is impossible and sterility is assured.

The fountain head itself may be attached to any standard fixture now in place. We supply Drinking Fountains in all styles equipped with the J-M Sanitor Bubbler and fittings to meet any requirement. Ask our nearest branch to show you this head and demonstrate it or send you explanatory literature.

There's a difference between covering steam pipes with "pipe covering" and insulating a steam line with the proper materials.

The business of Johns-Manville Heat Insulation Service is to recommend, sell and install a specific insulation for a specific requirement.

Steam insulation is a study in heat economy and not the dispensing of so many feet of pipe covering so many inches thick.

The purpose of J-M Heat Insulation Service is to furnish efficient insulation on your job so that when the work is done the system is as efficient thermally as it is possible to make it.

Every variety and combination of insulations are manufactured by the Johns-Manville Co. and Johns-Manville specialists are ready to recommend the proper insulation for your work. Why not let them confer with you?

One style of J-M Heat Insulation for pipes over 4½" diameter.

The Canadian H. W. Johns-Manville Co., Ltd.

Manufacturers of Asbestos Roofings; Pipe Coverings; Packings; Mastic Flooring; Conduit; Stack Lining; Fireproof Paint; Fire Extinguishers; Fuses; etc.

TORONTO MONTREAL WINNIPEG VANCOUVER

3132 D, 3100 B

Galt, Ont.—In the smallest vote polled in recent years, a by-law to raise $40,000 for the Waterworks Commission was recently carried by a majority of 169.

Sarnia, Ont.—The City Council is about to take steps to get water from the new waterworks at the lake shore. A scheme has been planned for improving the infiltration basins.

Listowel, Ont.—The hydro by-law authorizing the expenditure of $12,000 on a distribution plant was carried on Aug. 21. Of the above amount, $6,600 will be required in connection with the waterworks system.

Calgary, Alta.—The power and development committee of the City Council held a meeting recently, at which the proposed contract between the city and the Alberta-Electric Co. was endorsed and recommended to the City Council.

Chatham, Ont.—The City Council are considering the purchase of new pumps for the waterworks plant with a capacity of 2,000,000 and 3,000,000 gallons each. One of these pumps is to be a turbine, changeable from electricity to steam. William Gordon and Stewart Lamont are water commissioners.

Windsor, Ont.—Ratepayers voted on two money by-laws on August 18, and, despite very light attendance at the polls, both carried easily. The Devilbiss Atomizer Co. has been granted a fixed assessment of $10,000 on its new factory, and the issuance of $30,000 worth of debentures to cover the cost of local improvement work, completed last year, has been authorized.

General Industrial

Collingwood, Ont.—The Tobey Tannery Co., will make an extension to their plant.

Calgary, Alta.—The Western Canada Flour Mills Co. will build ten new elevators in this district.

Esquimalt, B.C.—The Imperial Oil Co. will commence shortly the erection of an oil refinery, to cost $175,000.

Kamloops, B.C.—H. Nixon is the president of a company who are developing a fruit canning industry in this district.

Milton, Ont.—The Milton Mfg. Co. are installing machinery in their new mill for making textile fabrics, such as plushes and velvets, etc.

Hamilton, Ont.—A by-law has been passed by the council granting permission for a factory to be built by an American firm, who propose locating here.

Three Rivers, Que.—It is rumored that another big pulp and paper mill is to be established in this city and the building of the plant will probably be commenced this fall.

Foremost, Alta.—The Ellison Milling Co. of Lethbridge, have commenced the erection of their new elevator at this point, which will be the third in Foremost. It is understood that the Lake of the Woods Milling Co. will also erect an elevator here, which will make the fourth.

Tenders

Toronto, Ont.—Tenders will be received up to Tuesday, August 31st, 1915, for the supply and erection of screens for windows and doors at the main sewage disposal works. Specifications and forms of tender may be obtained at the Works Department, City Hall.

Ottawa, Ont.—Tenders will be received until Tuesday, August 31st, 1915, for dredging required at mouth of Kaministiquia River, Fort William, Ont. Combined specification and form of tender can be obtained on application to the Secretary, Department of Public Works,, Ottawa.

Toronto, Ont.—Tenders will be received by the Board of Education until Friday, August 27, for all trades for new building, Dovercourt school grounds, Bartlett Ave. Specifications may be seen and all information obtained at the office of the Superintendent of Buildings, City Hall, Toronto.

Toronto, Ont.—Tenders will be received up to Tuesday, August 31st, 1915, for the supply and erection of an electric crane, hoist and single line clam shell bucket at the main sewage disposal works, Toronto. Specifications and forms of tender may be obtained at the Works Department, City Hall.

Regina, Sask.—Tenders will be received by the City Commissioners up till Monday, September 6th, 1915, for the supply, delivery and erection of a 7,000,000 gallon pumping unit at the city power house. Specifications and other information may be obtained from **J. M. MacKay**, Superintendent of Waterworks, Regina, Sask.

Ottawa, Ont.—Tenders will be received until Wednesday, September 1st, 1915, for the manufacture, delivery of, construction and erection complete of sluice pipes, valves, operating machinery and electrical equipment for Swift Rapids Dam, Trent Canal. Plans, specifications and forms of tender can be obtained by application to the chief en-

gineer, Department of Railways and Canals, Ottawa, or to superintending engineer of the Trent Canal, Peterboro, Ont.

Ottawa, Ont.—Tenders will be received at this office until Wednesday, September 8, 1915, for the construction of station, water tank, engine-house, transfer platform, standpipe pit, ash pit and turntable foundations for the Carleton Point Car Ferry Terminal, Prince Edward Island. Plans, specifications and form of tender may be obtained from the chief engineer, Department of Railways, and Canals, Ottawa; the chief engineer, Canadian Government Railways, Moncton, N.B.; and the engineer in charge, Car Ferry Terminals, Carleton Point, P.E.I.

New Incorporations

The Beaver Knitting Mills, Ltd., has been incorporated at Ottawa, with a capital stock of $75,000, to manufacture wearing apparel, in the village of Alton, Ont. Incorporators—Phebe Algie, Janet Dorrington, of Alton, Ont.

The J. R. Eaton & Sons, Ltd., has been incorporated at Ottawa, with a capital of $200,000, to take over the business of the J. R. Eaton & Sons, Ltd., of Orillia, Ont. Incorporators—James Russell Eaton, Edwin Russell Eaton, of Orillia, Ont.

La Compagnie d'Appareils Automatiques, Ltee, has been incorporated at Ottawa, with a capital of $200,000, to build and operate automatic distributors and automatic machines of all kinds at Montreal. Incorporators—Victor Lemay and Pierre Christie, of Montreal.

The Auto Products Co. has been incorporated at Ottawa, with a capital of $250,000, to manufacture automobiles, aeroplanes, auto cars and motor vehicles of all kinds, at Ottawa. Incorporators—Reynolds Delmeige Bray and William Joseph Halpin, of Ottawa.

McVitie & Price, of Canada, Ltd., has been incorporated at Ottawa, with a capital stock of $10,000, to carry on in Canada and elsewhere the business of biscuit manufacturers in all its branches at Montreal. Incorporators—Alexandre Chase Casgrain and Errol Malcolm McDougall, of Montreal.

Ideal Incinerator and Contracting Co. has been incorporated at Ottawa, with a capital stock of $250,000, to take over as a going concern the business carried on by the Ideal Incinerator and Contracting Co., Ltd., at Toronto. Incorporators—George Edward Farley and Allen Earle McFaul, of Toronto.

Advertising

"Advertising is the education of the public as to who you are, where you are, and what you have to offer in the way of skill, talent or commodity. The only man who should not advertise is the man who has nothing to offer the world in the way of commodity or service."—*Elbert Hubbard.*

Canada Cheese Box Co. has been incorporated at Ottawa, with a capital stock of $90,000, to manufacture cheese boxes, barrels ,etc., at Ottawa, Ont. Incorporators—Byron Moses and Robert Kenneth Milks, of Ottawa.

The T. & K. Industries, Ltd., has been incorporated at Ottawa, with a capital stock of $50,000, to carry on the business of mechanical and electrical engineers, tool makers, machinists, founders, metal workers, etc., at Montreal, Que. Incorporators — Henry Judah Trihey and Peter Bercovitch, of Montreal.

The Ottawa Valley Radial Co. has been incorporated at Ottawa, with a capital of $50,000, to manufacture all kinds of explosives, explosive apparatus, explosive by-products ,engine and other fuels, at Ottawa. Incorporators—O. Benjamin Villeneuve, Allan Joseph Fraser and W. J. McCarthy, all of Ottawa.

The Quebec Munitions Co. has been incorporated at Ottawa, with a capital of $50,000, to manufacture all kinds of war munitions, including high explosives and shrapnel shells, fuses, bullets, cartridges, grenades, small arms amunition of all sorts and descriptions at Montreal. Incorporators—Howard Murray, Charles Nicholas Monsarrat and Valentine Irving Smart, all of Montreal, Que.

Trade Gossip

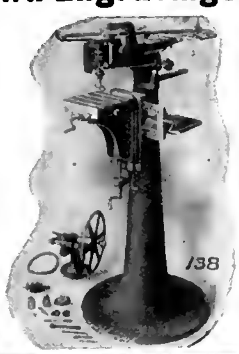
Lucknow, Ont.—The Lucknow Table Co. last week shipped 15,000 feet of lumber for export, to be used in making axles for gun carriages, soup kitchens, etc.

Regina, Sask.—Contract for 500 tons of reinforcing bars for the Robert Simpson Co. new warehouse, has been awarded to Burlington Steel Co., Limited, Hamilton, Ont.

Hamilton, Ont.—It is understood that the National Steel Car Co. has received an order from the Edmonton, Dunvegan and British Columbia Railway for ten stock cars. The value of the consignment was placed at $125,000.

American Foundrymen's Association.—The headquarters of the American Foundrymen's Association during Convention Week in Atlantic City will be the Hotel Traymore, instead of the Marlborough - Blenheim, as first announced.

The Chapman Double Ball Bearing Co., Toronto, are arranging an attractive display for the Canadian National Exhibition at Toronto, commencing Aug. 28th. Visitors will be able to see shells in pro-



cess of manufacture, including copper bands being pressed on. The "Chapman" elevating transfer truck and "Chapman" ball bearings will complete a most interesting exhibit.

Winnipeg, Man.—At a meeting of the Manitoba branch of the Canadian Manufacturers' Association held on Aug. 19, a war purchasing committee was appointed whose duties will be to put forth the claims of Winnipeg when war orders are being distributed, and will strive to influence the powers that be to make the purchases in the West on a larger scale than has been the case in the past. M. F. Christie is chairman of the committee.

Montreal, Que.—W. W. Butler, vice-president of the Canadian Car & Foundry Co., announced last Monday that an order for one hundred box cars, valued at $100,000, had been received from the Alberta Great Waterways Co., and the Edmonton, Dunvegan & British Columbia Railway. The company also secured an order from the same source for $10,000 worth of switch and frog materials, which will be manufactured by their subsidiary, The Canadian Steel Foundries.

Canada Asked to Tender.—The growing importance of Canada in the eyes of the other great portions of the Empire is indicated in the fact that Canadian manufacturers are being invited to tender for large supplies of materials required for the equipment of the North-western Railway of India. Copies of the forms of tender, etc., have been received by the Government at Ottawa. Thousands of brass and steel boiler tubes are called for.

National Steel Car Prospers.—The National Steel Car Co. is making a remarkable showing in point of earnings, which are now running in excess of $100,000 monthly. It is understood that the directors are considering putting the preferred stock on a regular dividend basis of 7 per cent. per annum shortly, and clearing up the back dividends, which will amount to $21 a share at the end of the current quarter. The matter of making up the arrears may, however, go over until the end of the year.

Ottawa, Ont.—It is announced that the new Government grain elevator, under construction at Calgary, will be completed and ready for use by the 1st of September. This completes the chain of internal terminal elevators built by the Government between the Great Lakes and the Mountains, those at Moose Jaw and Saskatoon being already in operation. All these elevators, including, of course, the big elevator at

the head of the lakes, will thus be available for the handling of this year's crop, of which, it is estimated, there will be 175,000,000 bushels for export. The Calgary elevator will have a capacity of two and a half million bushels.

Pembroke, Ont.—A fire recently recently destroyed the plant of the Hardware Specialty Co., the loss being estimated at nearly $15,000 all covered by insurance. The company will rebuild.

Personal

Hon. J. D. Hazen, Minister of Marine and Fisheries, has gone on a tour of inspection down the St. Lawrence. He will inspect the lifeboat and naval stations.

J. W. Eber, who resigned from the general managership of the Toronto, Hamilton & Buffalo Railway a few months ago, died in Hamilton, on Aug. 18.

Ernest L. Ganter, of St. John, N.B., has been appointed assistant inspector of gas and electricity, in the gas and electricity inspection district of St. John.

Josie & McLeod, 49 Gertie street, Winnipeg, are receiving prices and catalogues on hot water boilers, black, galvanized and cast iron pipes; hydraulic pumps, cast and galvanized iron fittings, etc.

Thos. Voyce, of Stratford, Ont., has been given a lieutenant's commission in the 33rd Overseas Battalion. Lieut. Voyce is the 160th employee of the Grand Trunk shops to leave on active service.

David A. Thomas, representative of the British war office on munitions in Canada, is visiting a number of plants in Hamilton, Ont., this week. He is accompanied by Generals Bertram and Mahon and two members of his staff.

R. O. Wynne-Roberts has opened an office at 310 Temple Building, Bay street, Toronto, where he will practice as a consulting engineer. Mr. Wynne-Roberts was at one time consulting engineer to the Saskatchewan Provincial Government investigating lignite deposits and later acted in a similar capacity for the city of Regina reporting on the water supply.

H. P. Meldrum, who for the last two years has been the assistant general secretary of the Canadian Manufacturers' Association in charge of the Eastern Division, has sailed for London, where he will join that part of the staff of the C. P. R. engaged in the purchase of equipment for the Imperial Government. Mr. Meldrum was at one time secretary of the Montreal Branch of the Association.

Contracts Awarded

Hanover, Ont.—The Spiesz Furniture Co., here have received an order for 10,000 shell boxes.

Charlottetown, P.E.I.—A. E. Ponsford, has been awarded the contract for constructing a reservoir at $1,932. and a fuel building at $887.

Toronto, Ont.—The Sheppard & Abbott Co., have been awarded a contract for heating and ventilating the Eglinton public school at $3,415.

Guelph, Ont.—A contract for laying about 4,900 feet of cast iron pipe has been awarded to Brennan & Hollingsworth of Hamilton, at $3,794.

Toronto, Ont.—The Johnson Temperature Regulating Co. will install their appliances in the Eglinton public school. The contract amounted to $747.

Brantford, Ont.—The Brandon Shoe Co. has received an order from the Canadian Government for 8,000 pairs of Canadian army shoes and 15,000 canvas rest shoes for wounded soldiers in hospitals.

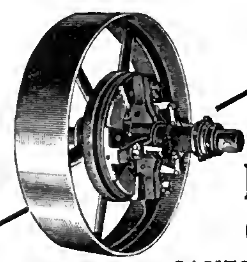
Catalogues

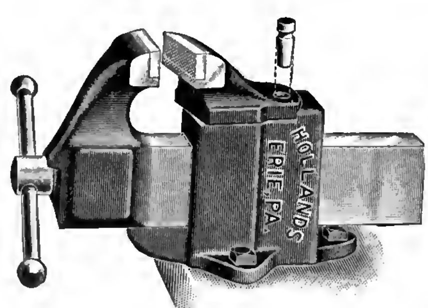
The Mott Sand Blast Mfg. Co., New York, N.Y., have had prepared for distribution four write-ups of different sand blast machines which they manufacture. Copies may be obtained upon application to the company.

Portable Tools, made by the Stow Mfg. Co., Binghampton, N.Y, are dealt with in bulletin No. 400. A complete line of belt and electrically-driven tools is described, which serves to show the different classes of work they are capable of doing. The bulletin is fully illustrated, and is being mailed to the trade.

Burning Crude Oil is the title of a bulletin dealing with one of the principal features of the De la Vergne oil engine, viz., the spray valve and vaporizer. A cross section through the cylinder head shows the construction of the apparatus. Copies of the bulletin may be obtained from the De la Vergne Machine Co., New York, N.Y.

Exhausters.—The Oneida Steel Pulley Co., Chicago, Ill., have issued a bulletin describing steel plate exhausters and cast iron blowers. The bulletin contains a speed, horse-power and pressure table, and also a price list for the exhausters. Another useful table gives the velocity and volume, etc., at given pressures. Among the illustrations are in-





cluded an efficiency curve and diagrams with dimensions for the various sizes.

Crude Oil Engines. — "Munktell" crude oil engines are described in a comprehensive manner in special catalogue No. 5. The method of operation is described at length, each part of the engine being taken in detail. Tables of prices and dimensions are included for each type, accompanied by illustrrations and diagrams. Copies of the catalogue may be obtained from the Canadian representatives, Hyde & Sons, Ltd., Montreal, Que.

Steam Trap Catechism is the title of a new booklet which has just been issued by the American Steam Gauge & Valve Mfg. Co., Boston, Mass. The booklet contains considerable information of interest to users of steam traps, and includes descriptions of various types. Other matter covers the operation of steam traps, water-hammer, and wire-drawing in steam traps, ratings, selection of suitable sizes and limits on buying steam traps, etc. An illustration is shown of the "American" Ideal" trap, accompanied by a diagram and table of dimensions. This booklet may be obtained from the head office of the company, or at any of the branches.

Shop Furnaces is the title of a bulletin recently issued by the American Shop Equipment Co., Chicago, Ill. The bulletin contains particulars covering a line of rivet forges, welding and forge furnaces, hardening and tempering furnaces, etc. The principal features of each type are described, while tables give the principal dimensions and shipping weights of each size. The bulletin has been gotten up particularly with a view to furnishing information for exporters, as the weights are given in both pounds and kilogrammes, and the shipping measurements in both cubic feet and meters. The bulletin is fully illustrated.

Pumps.—Rumsey & Co., Seneca Falls, N.Y., have issued their 1915 catalogue. This is the 56th edition of this publication. It describes an extensive line of hand, force, triplex and centrifugal pumps for all purposes such as domestic, farm, industrial and power plant installations. The catalogue contains a comprehensive description of each type of pump, together with tables giving the principal dimensions, weights, code word and price for each size. The concluding pages contain some useful information and tables for pump calculations, list of repair parts for "Rumsey" pumps with prices, telegraph code, alphabetical index and index to figures in addition to the general index. The catalogue contains 201 pages and is fully illustrated.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Embro, Ont.—H. McDonald will establish a general blacksmith shop here.

Brampton, Ont.—The Pease Foundry has received an additional order for shells.

Ridgeville, Ont.—The Chippewa Gas Co. propose to lay gas mains from Cayuga to St. Catharines.

Ottawa, Ont.—The Russell Natural Gas & Oil Co. is in the market for drilling equipment and pumps.

Calgary, Alta.—The Canadian Western Foundry & Supply Co., with plants in Alberta cities, have received a large order for shells.

Brantford, Ont.—A building permit has been issued to the Brantford Emery Wheel Co. for a $1,500 brick addition to their factory here.

Wingham, Ont.—Owing to increased business, the Western Foundry Co. expects to recommence operations in the new portion of their plant.

London, Ont.—The Wortman & Ward Co. will build an addition to its factory to cost $20,000. The company manufactures iron force and lift pumps, etc.

Welland, Ont.—It is reported that the Electric Steel & Metals, Ltd., are considering building an extension to their plant and installing another furnace.

St. Mary's, Ont.—Additions will be made to the plant of the Thames Quarry Co. A new crusher building, 30 x 60 ft., will be built and new machinery installed.

Lake Megantic, Que.—P. H. Renaud is preparing plans for the erection of a pulp mill. New machinery, including "Baker" cut-off saws, a 70-h.p. engine, etc., will be required.

Nelson, B.C.—The Ivanhoe concentrator at Sandon, B.C., was totally destroyed by fire on Aug. 30. The plant, valued at about $50,000, was treating ore from the Lucky Jim and Surprise mines.

Municipal

Brandon, Man.—The City Council has authorized the extension of the street lighting system.

Beeton, Ont.—The town council contemplate the purchase of boiler and power house equipment.

Guelph, Ont.—The city council will take immediate steps to secure a pulmotor, which will be placed at the firehall.

Oshawa, Ont.—The town council have passed the first reading of a by-law dealing with the steel plant which it is proposed to establish here.

Petrolea, Ont.—The town council has ordered the Hydro-Electric Power Commission to proceed with the construction of an entirely new outfit for the distribution of the hydro light and power.

Sudbury, Ont.—The town council have given permission for the Sudbury and Copper Cliff Suburban Electric Railway Co. to install an electric generating unit in the civic waterworks pumping station.

New Toronto, Ont.—The town will extend its intake 350 feet farther out in the lake, where the water is 25 feet deep. Upon the recommendation of Engineer E. A. James, a tender to do the work for $5,000 was accepted.

Brockville, Ont.—Work is progressing favorably on the preliminary operations necessary for laying the new intake pipe for the Waterworks Department. The Donnelly Wrecking Co., of Kingston, Ont., are the contractors.

Prince George, B.C.—The ratepayers of this city passed four money by-laws as follows:—$80,000 on waterworks; $45,000 on electric light and power system; $15,000 on street improvements, and $10,000 on a city hall.

St. Catharines, Ont.—The ratepayers of St. Catharines will on September 21 vote upon a by-law to grant a franchise to the Relief Natural Gas Co., composed of local capitalists, for the supply of gas to the civic gas plant system.

Moose Jaw, Sask.—The council has decided to purchase from the Turbine Equipment Co., of Toronto, a new electrically-driven pump. The pump is to have a capacity of 700 Imperial gallons per minute, and is for use in pumping crude sewage at the disposal plant.

Markham, Ont.—The village council has decided to install new water mains in the village, also a new tank and collecting basin. The tank is to be 150 feet high and the capacity will be 60,000 Imperial gallons. This new scheme, it is estimated, will cost slightly under $15,000.

Berlin, Ont.—Plans for extension of Berlin's sewage disposal plant have been approved by the Provincial Board of Health. They were prepared by Engineer W. Chapman, of Toronto, and it is expected that when the work is completed the city sewage disposal problem will be solved for some years to come. The cost of the extension will be about $75,000.

Markham, Ont.—At a special meeting of the village council held on Aug. 27, it was decided to submit a by-law to the ratepayers, authorizing the raising of $20,000 for the construction and installation of a modern waterworks system, for both domestic and fire protection purposes. The measure will be given its first reading on Wednesday next, and the vote will be held on October 2nd.

Petrolea, Ont.—The town council on Aug. 23 ordered the Hydro Commission to proceed with the construction of an entirely new outfit for the distribution of the incoming hydro light and power. This action followed the expiry of the time set in which the Petrolea Co. had the option of selling to the town its plant for $15,000. The council turned down the proposed compromise of $16,200 offered by the company.

Weston, Ont.—Providing the Etobicoke Township Council will guarantee sufficient private contracts to secure the Weston Water, Power and Light Commission financially, the latter are quite willing to proceed with the proposed Hydro extension to Thistletown according to their decision at a special meeting held on Aug. 24. The linking up of Thistletown with the local system will involve an expenditure of about $3,200.

Electrical

Granton, Ont.—The vote on the hydro by-law will be taken on September 28, and there seems no doubt that it will pass by a large majority.

St. Thomas, Ont.—The local Hydro-Electric Commission has purchased the property at the corner of Gas and St. Catharine streets for $3,000, and will erect a modern power-house and transmission station. Plans and specifications for this structure are now being prepared by the Provincial Commission.

Trade Gossip

Hespeler, Ont.—The employees of A. B. Jardine & Co. have contributed over $100 towards the purchase of a machine gun.

The Canada Forge Co. and Canadian Billings & Spencer Co. employees and officials have raised $1,000 for a machine gun.

Owen Sound, Ont.—The Northern Bolt & Screw Co. have taken over the Dominion Bolt Co. of West Toronto and will remove the machinery here.

The Cleveland-Sarnia Sawmills have now in their booms in Sarnia Bay, Ont., about 12,000,000 board feet of logs, which are to be sawn up this fall and winter.

The Canadian Fairbanks-Morse Co., Montreal, have been awarded the contract for the conveying machinery for the addition to the No. 1 elevator for the Montreal Harbor Commission.

Windsor, Ont.—The Windsor Industrial Bureau was organized on Aug. 19 in the Board of Trade rooms. Ald. Winter was chosen chairman and T. C. Ray will be the secretary-treasurer. The Board of Trade has raised $960 in subscriptions so far.

The Boving Hydraulic and Engineering Co., Ltd., has been reorganized with the following directorate:—President, Major R. W. Leonard; vice-president, Wm. Flavelle; secretary-treas., T. H. Stinson; directors, Alex. Longwell, Sydney B. Kendall, W. K. George, Jens Orton, Boving, London, England.

Montreal, Que.—Bondholders of the Canadian Cereal and Milling Co. met here on Aug. 26 and decided upon definite plans of reorganization. It was decided to apply to Ottawa for incorporation papers and to organize a new company, which will start with a bond issue of $300,000 and a common stock issue of about $500,000.

The Canadian Locomotive Co., Kingston, Ont., are working on orders for thirty large locomotives for the Russian Government. Russia is thoroughly re-organizing its railway system, which will involve a standardizing of roads, and this will facilitate the filling of later orders by Canadian concerns. The Canadian Locomotive is also filling orders for the Federal Government.

Hamilton, Ont.—In addition to the 400-foot extension to the plant of the Steel Company of Canada, in which have been installed a number of presses for making shells, the company is at work now on a new open hearth furnace for the purpose of supplying raw material for shell making. This new departure will enable the company to secure a primary profit in addition to that of mere assembling of shells.

The Canada Steamship Lines have about twenty per cent. of their vessels serving on the ocean traffic at the present time. While the passenger business of the company, taken altogether, has not been quite up to normal this season, revenue from ocean freight traffic has been substantial. Lake freight rates are high this season, and traffic from the west will be a paying proposition. It is stated that after the interlake season closes a considerable proportion more of the freighter fleet will be transferred to the ocean trade, and in this way a revenue will be maintained during some four months that is usually a blank on the company's books.

General Industrial

London, Ont.—Beatty Bros. will build an addition to their factory to cost $3,000.

Ridgetown, Ont.—D. P. McNorgan of London, Ont., contemplates erecting a flour and grist mill here.

St. Marys, Ont.—William Weir has bought the old Brown Milling Co. property and will convert it into a knitting mill.

Hamilton, Ont. — The Frost Wire Fence Co. will build an addition to their factory. G. E. Mills is the general contractor.

East Toronto, Ont.—One thousand dollars damage was done by a fire which broke out in the drying plant of the Chapman Brock Co., Dawes Road, on August 30.

Vancouver, B.C.—The W. H. Malkin Co. will build a factory. Machinery for the manufacture of food products, etc., will be required.

Parry Sound, Ont.—A fire caused by lightning destroyed two drying houses at the Canadian Explosive Co. plant here on Aug. 24.

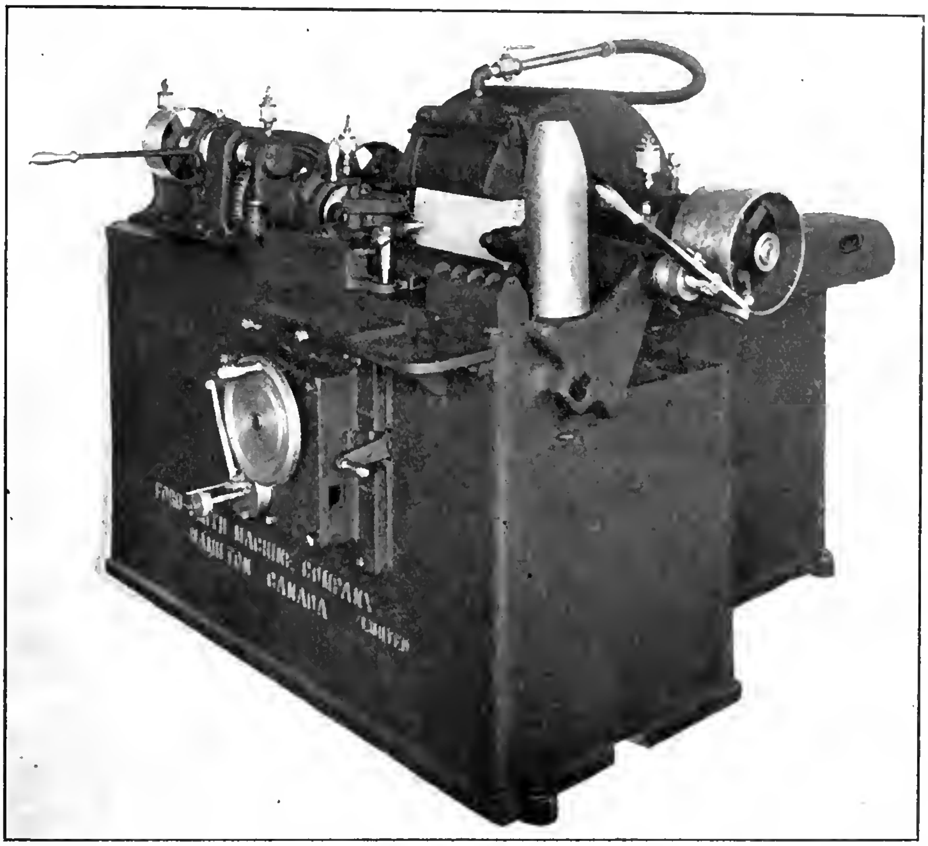
Montreal, Que.—C .H. Johnson & Sons, Ltd., will build an addition to its factory to cost $3,000. The company manufactures wire guards for machinery and other wire goods.

Railways-Bridges

Hamilton, Ont.—A hydro-radial line to St. Catharines and intermediate points is projected.

Three Rivers, Que.—Operations have commenced on the construction of a

The Ford-Smith Shell Grinder



Cut shows trueing device in position on machine arranged for finishing 4.5 shells in one operation.

Unskilled help only required to finish your shells accurately on this Grinder. Does the work of three to five lathes.

Operated entirely from one position; right in front of machine. Nothing to get out of order, and with Belt Power and rigidity to spare.

Our latest model, shown above, is the heaviest and most powerful Grinder on the market for finishing Shrapnel and High Explosive Shells.

Fifty-three of these Grinders are in operation in Canada, United States, and Great Britain, at least one-third of these being repeat orders.

We have evolved a very simple, efficient and inexpensive method of trueing the wheel, using the diamond device only occasionally, and eliminating a big source of expense over earlier practice.

Shells ground in one operation on this machine are true and concentric from base to nose, and the finish is perfect.

We also arrange the machine to grind either body or nose separately for customers whose sequence of operations falls short in this respect.

This machine will solve your lathe question on the finishing operation, and release lathes more suited to roughing and other operations.

The machine is sold complete, ready to run on your particular shells, and our expert's service included. This is not a superficial showing off of the machine, but includes the instruction of your own operators to produce the output.

Get the price and further particulars to-day. Deliveries from stock or within one week.

List of users on application.

The Ford-Smith Machine Company, Limited

HAMILTON, CANADA

If what you want is not advertised in this issue consult the Buyers' Directory at the back.

street railway. The Three Rivers Traction Co. are the owners.

Guelph, Ont.—The Toronto Suburban Railway have almost completed the new electric railway from Toronto to Guelph. Some overhead construction has still to be finished at this end.

Trenton, Ont.—The council will probably submit a by-law shortly for the purpose of authorizing an issue of debentures for $40,000 to cover the town's share of a new bridge. The total cost is estimated at $127,183, the Government paying the balance.

Windsor, Ont.—Plans for a $45,000 bridge on Wyandotte Street, across the M. C. R. tracks, have been approved of by the city council, and the city solicitor has been instructed to make application to the Dominion Railway Board for an order directing the work to be done.

Winnipeg, Man.—The laying of steel on the twenty-five miles of grade east of Foremost, Alta., on what will ultimately be known as the Lethbridge-Weyburn branch of the Canadian Pacific Railway will be started immediately, it has been announced. It is the intention of the company to rush the work to completion as fast as possible.

Refrigeration

Amherstburg, Ont.—The Falls Barron Co. will build a cold storage plant to cost $10,000.

Victoria, B.C.—The establishment of a public abattoir is being considered by the city council. Estimated cost of plant is $20,000.

Amherstburg, Ont.—The erection of a cold storage plant, at an estimated cost of $10,000, is contemplated by the Falls Barron Co. of this town.

St. Thomas, Ont.—The St. Thomas Packing Co., Ltd., may rebuild a portion of their plant, which was recently destroyed by fire. General Manager, J. Moody.

Tenders

Tavistock, Ont.—Tenders will be called at once for the erection of a distribution station in Tavistock for hydro-electric power.

Winnipeg, Man.—Tenders are now being called for the construction of a bridge at Headingly, to be built by the municipality of Assiniboia, with assistance under the Good Roads Act.

Toronto, Ont.—Tenders will be received up to Tuesday, September 7th, 1915, for constructing radial brick chimney for incinerating plant on Don Roadway. Specifications and form of tender may be obtained at Street Commissioner's Office.

Regina, Sask.—Tenders will be received by the City Commissioners up till Monday, September 6, 1915, for the supply, delivery and erection of a 7,000,000-gallon pumping unit at the city power house. Specifications and other information may be obtained from J. M. MacKay, superintendent of waterworks, Regina, Sask.

Quebec, Que.—Tenders for storage dam at the outlet of Lake St. Francis will be received at the office of the Quebec Streams Commission, Room 264, Parliament Buildings, Quebec, until Tuesday, September 7, 1915. Plans and specifications can be seen at the above office or at the Quebec Streams Commission's office, Room 803, McGill Building, Montreal.

Berlin, Ont.—Tenders will be received by the City Clerk until Tuesday, September 7th, 1915, for the construction of sewage disposal works, comprising tanks, filters, sludge beds and pumping station. Plans and specifications may be seen at the office of the Consulting Engineers, Chipman & Power, 204 Mail Building, Toronto, also at the City Engineer's Office, Berlin.

Toronto, Ont.—Tenders for underground work, addressed to the Chairman of Toronto Electrical Commissioners, will be received until Tuesday, Sept. 7. Details of work to be performed consisting of laying cable ducts, building manholes and transformer vaults. Plans specifications and form of tender may be obtained at the Purchasing and Engineering Dept., 15 Wilton avenue.

Ottawa, Ont.—Tenders will be received at this office until Wednesday, September 8, 1915, for the construction of station, water tank, engine-house, transfer platform, standpipe pit, ash pit and turntable foundations for the Carleton Point Car Ferry Terminal, Prince Edward Island. Plans, specifications, and form of tender may be obtained from the chief engineer, Department of Railways and Canals, Ottawa; the chief engineer, Canadian Government Railways, Moncton, N.B.; and the engineer in charge, Car Ferry Terminals, Carleton Point, P.E.I.

Personal

R. A. Spawton, of Halifax, N. S., is to be appointed purchasing agent of the Department of Marine and Fisheries at Halifax.

P. J. Flynn, present manager of the Winnipeg joint terminals, has been ap-

Shrapnel and High Explosive Grinding Wheels

Just a few of the many shapes and sizes we are making for this work are here illustrated, all made of our own artificial abrasive

"REXITE"

(CORUNDUM)

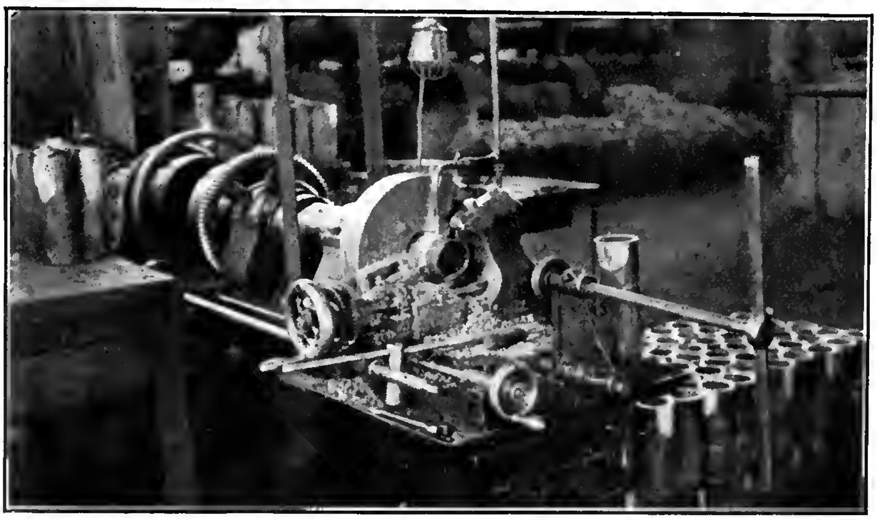
by either silicate or vitrified process, can give you the names of many satisfied customers for whom we have **increased production and lowered costs.**

Ask our Service Department for information concerning your grinding needs.

Canadian Hart Wheels, Limited

MANUFACTURERS OF GRINDING WHEELS AND MACHINERY

HAMILTON, CANADA



pointed superintendent at Winnipeg for the Canadian Northern Railway.

W. J. Doherty has resigned the position of general sales manager of the Northern Electric Co., Montreal, with a view to going into business in Chicago.

John McMillan, formerly manager of the Ontario factory of L'Air Liquide Society, Paris, France, is now handling the oxygen department of Lever Brothers, Ltd., Toronto.

Major C. N. Monsarratt, who is chief of the board of engineers of the Quebec Bridge, has succeeded Lieut.-Col. J. G. Ross as officer commanding the 5th Royal Highlanders of Canada.

Thomas R. Hilyard, surviving member of the original firm of Hilyard Brothers, shipbuilders and mill owners of St. John, N.B., died at his residence on Douglas avenue on Aug. 19. Mr. Hilyard was in his 74th year.

F. W. Wegenast, barrister, announces that he has severed his official connection with the Canadian Manufacturers' Association, and has opened an office for consultation and general practice at 901 Traders Bank Building, Toronto.

Hon. Frank Cochrane, Minister of Railways, leaves on the 5th of September for a tour of inspection of the Transcontinental and Grand Trunk Pacific Railways. It is expected that Mr. Cochrane will go through to the coast.

John A. Carrick of Port Arthur, and at one time assistant general manager of the Queen City Oil Co., died in Toronto on Aug. 24. Mr. Carrick was the father of Lieut.-Col. J. J. Carrick, M.P., of the headquarters staff of the Canadian Expeditionary Force.

William Leach, president and manager of the Leach Concrete Co., Toronto, died at his home, 353 Palmerston Boulevard, on August 27. He was in his 48th year. Deceased was born in London, Eng., and had lived in Toronto for 35 years, establishing the business fifteen years ago.

A. B. Stanbury, who has been measuring surveyor of shipping for the Port of Toronto since 1908, has resigned. William Evans, inspector of hulls and equipment; John Dodds, James B. Stewart and George M. Arnold, inspectors of boilers and machinery, all of Toronto, have been appointed as officers to superintend the survey and measurement of ships and surveyors of accommodation for seamen at the Port of Toronto.

C.M.C.

FINISHING 18 Pr.
LYDDITE SHELL BASES

C.M.C.

C.M.C. ENGINE LATHES

Our Lathes, with and without turrets, are installed in the works of the shell makers in Canada.

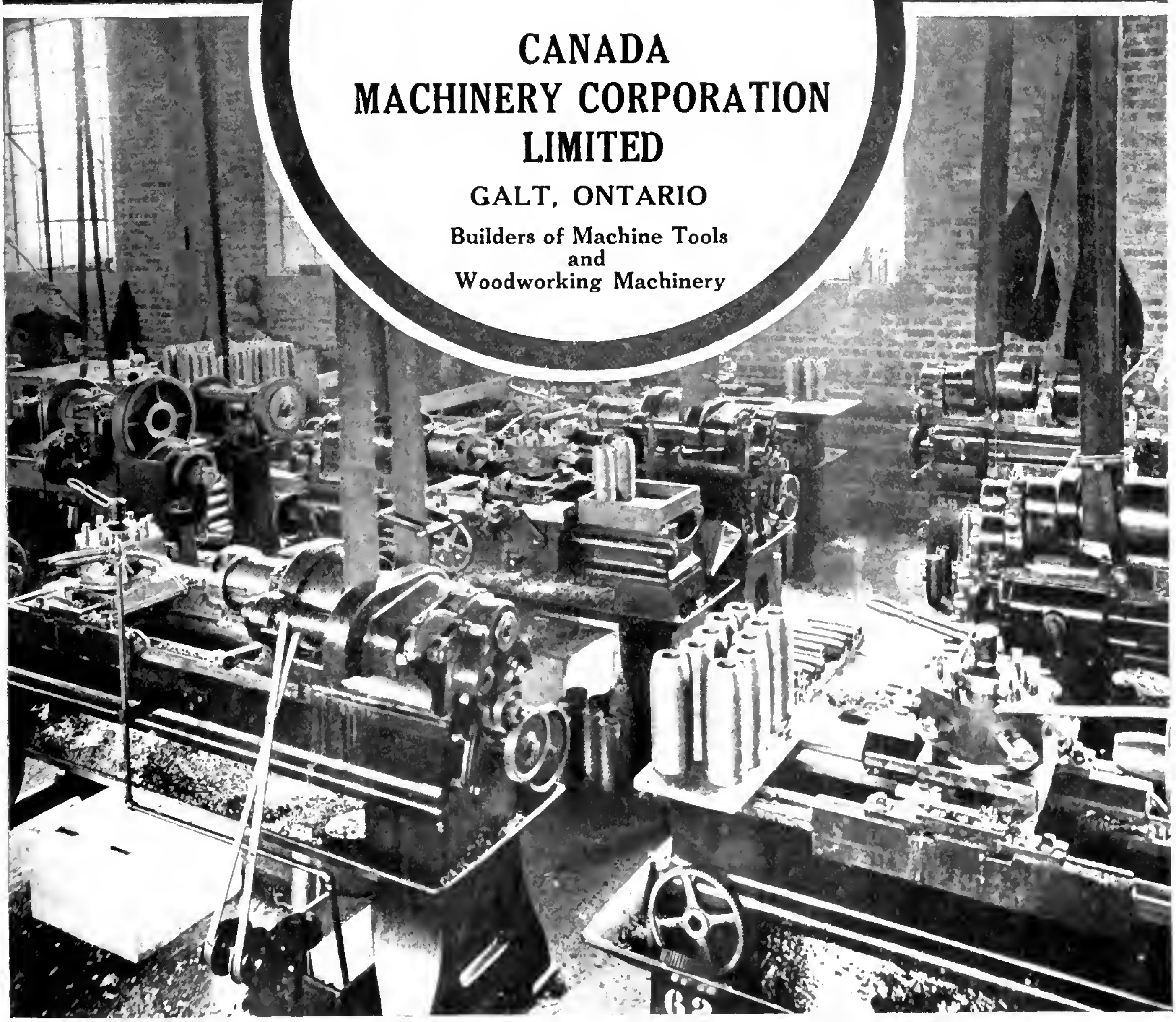
They are maintaining their reputation for accuracy and rigidity under the most severe service.

Write for prices and deliveries

CANADA MACHINERY CORPORATION LIMITED

GALT, ONTARIO

Builders of Machine Tools and Woodworking Machinery



R. W. ASHCROFT HONORED

A NUMBER of American manufacturers, such as the Winchester Repeating Arms Co., the Yale & Towne Mfg. Co., Berry Brothers, Ltd., L. S. Starrett & Co., and thirty-six others, who are members of an organization known as the Rice Leaders of the World Association, have conferred a high honor on one of Montreal's business men.

Somewhat over a year ago, they offered nearly $3,500 cash prizes for ideas and suggestions. This was open to anybody, and the ideas and suggestions could relate to production, sales, advertising or anything else.

The object of the offer was to develop suggestions that would tend to improve the methods or products of these American manufacturers.

But one idea could be submitted to each manufacturer, no two ideas could be alike, and each idea had to be compressed into fifty words.

R. W. ASHCROFT.
Manager of publicity for the Canadian Consolidated Rubber Co., Limited.

Thousands of Americans entered the contest, together with a few Canadians, Britishers and others, and the Second Prize of $500 cash has been won by a Canadian, R. W. Ashcroft, of Montreal, who is manager of publicity for the Canadian Consolidated Rubber Co., Limited, and Associated Companies.

In presenting the prize, Elwood E. Rice, president of the association, wrote Mr. Ashcroft as follows:

"To have earned this second prize in this international competition where people in all walks of life from all parts of the world entered, is cer-

"Hercules" Twist Drills

FOR HIGH EXPLOSIVE SHELLS

PROOF OF THE BACKBONE OF A DRILL IS IN DRILLING SHELLS.
IF A DRILL HAS ANY WEAKNESS THIS CLASS OF WORK WILL QUICKLY BRING IT OUT.
THE "HERCULES" HAS SCORED A WONDERFUL SUCCESS IN MUNITION PLANTS—A FACT THAT STRONGLY RECOMMENDS IT FOR ANY DRILLING JOB IN THE PLANT.
The "Hercules" superiority is due to the use of High Percentage Vanadium High-Speed Steel and the only "**Twisted-While-Hot-Process**" that retains all the strength of the steel in the finished drill. The backbone is all there because the grain of the steel is undisturbed, insuring longer edge-holding and greater resistance to the strains of drilling the toughest of metals.
We also make special Finishing and Roughing REAMERS for shells.

The Whitman & Barnes Mfg. Co.
Established 1854
St. Catharines,
Ontario

tainly a great evidence of your unusual ability, and in which you are indeed justified in taking exceptional pride.

"I extend to you my best wishes for the continued success your able efforts so richly deserve."

This is not only a feather in Mr. Ashcroft's cap, but is also a compliment to the business ability of Canadians, particularly in view of the fact that Mr. Ashcroft only heard of the contest a few weeks before it closed last May, and therefore had but very little time in which to compile and submit his ideas.

No special publicity was given to the contest in Canada, so those resident in the United States, who had a whole year in which to evolve ideas, naturally had a better opportunity than Canadians to successfully compete.

Contracts Awarded

Brampton, Ont.—The Copeland-Chatterson Co. have let the contract for an addition to their factory to Hill & McCulloch.

Renfrew, Ont.—The Renfrew Electric Co. recently received a large order from the Northern Electric Co., which hitherto had been buying these particular goods from an American concern.

Montreal, Que.—The contract for the structural steel for the addition to No. 1 elevator for the Harbor Commission has been let to the Dominion Bridge Co., Lachine, Que.

The Canadian Brakeshoe Co., of Sherbrooke, Que., have placed an order for the installation of a Snyder electric furnace for the melting of steel. The steel will be used for the manufacture of 4 in. rounds to be forged into shells for the British Government. The Snyder electric furnace is being installed under guarantee as to operating cost. These furnaces are built by the Snyder Electric Furnace Co., Chicago, Ill.

Wood-Working

Matsqui, B.C.—T. Z. Smith will build a factory for the manufacture of boxes.

Sidney, N.S.—Wrights, Ltd., will build a furniture factory to cost $25,000.

Petrolia, Ont.—R. D. Hall will build a factory for the manufacture of gates and woodenware of all kinds.

Montreal, Que.—H. A. Broehu, 294 St. Catherine street, east, is asking information and prices on wood-working machinery, etc.

Bishops' Falls, Nfld.—The Albert F. Reed Co. plans the erection of a factory for the manufacture of wood pulp, lumber, timber, etc.

Classified Advertisements

¶ Those who wish to sell or buy a business, obtain competent help, connect with satisfactory positions, or secure aid in starting new enterprises, should not fail to use the Want Ad. Page of "CANADIAN MACHINERY."

ONE DOUBLE END PUNCH AND SHEARS, 22" throat, about 7,000 lbs. This is new; punched one bridge, $500.00; also one 9" throat punch, ½". A. Dick & Sons, Alton, Ont.

WANTED—DRAWINGS OR BLUE PRINTS of turrets suitable to go on carriages and also on shears of 14", 16", 18" and 20" engine lathe. Box 154, Canadian Machinery.

Bury, Que.—**L. H. Martin**, whose sawmill was recently destroyed by fire, with a loss of $8,000, will rebuild and will be in the market for new machinery.

Catalogues

Norton Ball Bearing Jack made by A. E. Norton, Ltd., Coaticook, Que. Catalogue No. 28 describes a complete line featuring the various types of ball-bearing jacks. Tables give the principal dimensions, weight and list price of each size, and are accompanied by illustrations of the different types and repair parts. Interested readers may obtain copies by writing the company.

Link-Belt and Sprocket Wheels.—The Link-Belt Co., Philadelphia, Pa., are distributing Section A of general catalogue No. 110, dealing with the original "Ewart" detachable link-belt and sprocket wheels. A large number of full-size cuts are shown of standard and special sizes of "Ewart" link-belts and a number of attachments are also illustrated. The catalogue also contains a brief description and price list of attachments, also price lists of sprocket wheels and "Ewart" detachable link-belts.

Betson's Plastic Fire Brick for one-piece boiler furnace linings is the title of a 20-page booklet being distributed. The Betson Plastic Fire Brick Co. Rome, N.Y., make this material. The booklet tells how to construct a solid gas-tight, one-piece boiler furnace lining throughout from this plastic refractory material without the use of any special tools. It gives directions for the testing of boiler settings for air leaks, and for the immediate repair, without shut-down, of cracks and holes, to preserve the life of ordinary brick linings to the time when they can be replaced. Illustrations and diagrams show the one-piece lining as applied to the several types of boilers in general use. Copies of this book will be sent on request to those concerned with the management of boilers.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Sherbrooke, Que.—The Eustis Mining Co. plant has been destroyed by fire, the loss being estimated at $50,000.

Murray Bay, Que.—The boiler-room and laundry at the Manoir Richelieu have been destroyed by fire, the loss being estimated at $20,000.

Brighton, Ont.—The D. J. Barker Foundry Co. have let the contract for the erection of a foundry to Thomas Garnett & Sons, Port Hope. Estimated cost, $13,000.

Burnaby, B.C.—The Shell Oil Co. will spend $110,000 on improvements and buildings to be constructed at its plant as well as the erection of six tanks with a capacity of from 5,000 to 38,000 gallons each.

Hamilton, Ont.—The Canadian Horse Shoe Co. which was recently incorporated with a capital stock of $300,000, is erecting a plant which will represent an outlay of $150,000. The plant will ultimately require the addition of a rolling mill.

Chatham, Ont.—Representatives of an automobile concern, believed to be located in Brantford, are negotiating with the Canadian Wolverine Mfg. Co. for the purchase of their plant on St. Clair Street, apparently with the object of starting the manufacturing of automobiles here. The Wolverine Co. has decided to discontinue manufacturing certain lines of brass goods, but have not formulated definite plans for the future.

Municipal

Thetford Mines, Que.—A waterworks system will be installed at a cost of $12,000.

New Westminster, B.C.—The City Council are considering laying a 14-in. water main to cost $15,000.

Edmonton, Alta.—A by-law is contemplated to raise $250,000 for the building of a sewage disposal plant.

Guelph, Ont.—The city will spend $24,500 on extensions to be made to the water works plant. F. McArthur is the engineer.

Listowel, Ont.—The by-law providing for the construction of a waterworks system has been carried, and tenders will be called shortly. Approximate cost, $5,400.

Cochrane, Ont.—The Town Council will shortly call for tenders on extensions to the water and sewerage systems.

Welland, Ont.—A by-law will be voted on by the ratepayers on Sept. 20 to fix an assessment of $5,000 for ten years to the Weedon Mining Co., who propose establishing a zinc smelter here.

Youngstown, Alta.—A by-law is contemplated to provide $8,400 for the purchase of fire apparatus, sinking well, building fire hall, and putting in tank and reservoir.

Markham, Ont.—The village council have decided to submit a by-law to the ratepayers on October 2, authorizing the raising of $20,000 for the construction and installation of a modern waterworks system.

St. Hyacinthe, Que.—A by-law will be submitted to the ratepayers on September 16 providing for the construction of gravity filters and the installation of two pumps, motor, boilers, pipe connections, valves, etc., estimated to cost $75,000.

CANADIAN GOVERNMENT PURCHASING COMMISSION

The following gentlemen, constitute the Commission appointed to make all purchases under the Dominion $100,000,000 was appropriation:—George Gault, Winnipeg; Henry Laporte, Montreal; A. E. Kemp, Toronto. Thomas Hilliard is secretary, and the commission headquarters are at Ottawa.

Owen Sound, Ont.—At a joint meeting of the Utilities Commission and the Finance and Fire Committees held on September 1, it was decided to recommend to the council the extension of the high pressure waterworks system to the factory district on the west side of the town. It is estimated that the cost of the proposed extensions will be in the neighborhood of $5,000.

Electrical

Dutton, Ont.—Hydro was officially turned on here on August 30 by Sir Adam Beck.

Harriston, Ont.—At a special meeting of the Town Council the hydro-electric by-law, recently approved by the ratepayers, was given its third reading.

Chatham, Ont.—At a meeting held at Kent Centre on August 20 farmers of the district decided to have an engineer prepare estimates of the cost of erecting a hydro distributing line into that part of the county.

General Industrial

Winnipeg, Man.—The Auto Light Gas Mfg. Co. will build a new plant at 462 Lipton street.

Ottawa, Ont.—The Ottawa Sanitary Laundry Co. is building a new laundry at an estimated cost of $40,000. M. M. Pyke is manager.

Winnipeg, Man.—The Concrete Post Co.. which already has factories in Saskatchewan and Ontario, has recently secured quarters for a factory in Winnipeg situated on James street east.

Cochrane, Ont.—The Metagami Pulp & Paper Co. are about to commence operations in connection with the establishment of a pulp and paper mill on the Metagami River, thirty miles west of this place

Building Notes

Montreal, Que.—A permit has been issued to the Ogilvie Flour Mills Co. for alterations to their mill here. The cost is estimated at $3,500.

Port Arthur, Ont.—A permit has been issued to the National Elevator Co. for the erection of an elevator at Third Avenue and King street. Approximate cost, $15,000.

Hamilton, Ont.—The Canadian Cartridge Co. have secured a permit to extend their office building at a cost of $2,000. Christman & Co. have the contract.

Winnipeg, Man.—All the tenders for the new Ford building to be erected at the corner of Portage Avenue and Wall Street are now in, the time limit having expired.

Winnipeg, Man.—Work has started on a contract which the Carter-Halls-Aldinger Co. has obtained for the erection of a big assembling plant for the Ford Company at Portage avenue and

Wall street. The building, which will cost about $200,000, will be of reinforced concrete, with exterior walls of red, pressed brick. It will be 200 feet by 150 feet, and will be four storeys high.

Contracts Awarded

Berlin, Ont.—The Kaufman Rubber Co. has received an order for hip boots from the British Government, valued at $40,000.

James Malcolm, of the Andrew Malcolm Furniture Co., Kincardine, Ont., has secured a contract for the making of shell boxes.

Lachine, Que.—The contract for the construction of an incinerator has been let by the City Council to the Atlas Construction Co., Montreal, at $9,000.

Point Pelee, Ont.—The contract for the erection of a lighthouse tower has been let by the Department of Marine and Fisheries, Ottawa, to Charles Mattaini, Fergus, Ont., at $8,490.

Toronto, Ont.—Contract for supply and installation of 7,000 ft. 13,200 volt, paper-insulated, lead-covered cable has been awarded to Eugene Phillips Electrical Works, Montreal, by the Toronto Hydro-Electrical System.

Maillardville, B.C.—The Widdess, McDonald Co., of Vancouver, have been awarded the contract for supplying the material necessary for the installation of the Maillardville water system at a figure of $3,249.25 by the Coquitlam Council.

Drumheller, Alta.—The following contracts have been awarded in connection with the installation of the waterworks system:—E. R. Leverton, Calgary, construction of system, $5,170; elevated tank and housing, Vancouver Wood Pipe & Tank Co., Vancouver, $1,145; duplex pump, Canadian Western Foundry & Supply Co., Calgary, $410; boiler, etc., E. Leonard & Sons, Ltd., Calgary, $1,127; hydrants, Empire Waterworks Supply Co., Winnipeg, $47.11 each; 6-inch valves, Canadian Western Foundry & Supply Co., $10.77 each; 6-inch steel pipe and specials, General Supplies, Ltd., Calgary, 59c per foot.

New Incorporations

The Patent Grates Co. has been incorporated at Ottawa, with a capital of $50,000, to manufacture patent boiler grates at Sorel, Que. Incorporators—Arthur Langlois, Francis Hurtubise, of Montreal.

The Burnall, Ltd., has been incorporated at Toronto, with a capital of $100,000, to manufacture lighting and heating plants at Toronto. Incorporators—Bessie Cook, William Henry Latimer, of Toronto.

Everyman's Car Co. has been incorporated at Ottawa with a capital of $40,000 to manufacture motor cars, trucks and motor vehicles of all kinds at Ottawa. Incorporators, Arthur Meredith Jacques, Frank H. Jacques, and Charles A. Jacques, all of Montreal.

British-American Chemical Co. has been incorporated at Ottawa with a capital of $50,000 to manufacture chemical for medicinal and industrial purposes at Montreal. Incorporators, Errol Languedoc, Ralph Erskine, Allan and Ernest Copeland, all of Montreal.

The Excel Chemical Co. has been incorporated at Ottawa, with a capital of $1,000,000, to manufacture all kinds of chemicals, explosives and other products of a similar nature at Montreal, Que. Incorporators—Eugene H. Godin and Joseph E. Morier, all of Montreal.

ALLIES' PURCHASING AGENTS

The Trade and Commerce Department, Ottawa, has published the following list of purchasing agents for military purposes for the allied Governments:—

International Purchasing Commission, India House, Kingsway, London, Eng.

French.—Hudson Bay Co., 56 McGill Street, Montreal; Captain Lafoulloux, Hotel Brevort, New York; Direction de l'Intendance Ministere de la Guerre, Bordeaux, France; M. De la Chaume, 28 Broadway, Westminster, London.

Russian.—Messrs. S. Ruperti and Alexsieff, care Military Attache, Russian Embassy, Washington, D.C.

The Flexible Metal Hose Co. has been incorporated at Ottawa, with a capital of $200,000, to take over the business of Charles Forth, manufacturer of flexible metal hose and other products. Incorporators—James B. Watson, Francis E. Higgerty, of Ottawa.

The Zinc Co. has been incorporated at Ottawa, with a capital of $100,000, to operate zinc mines and smelters at Sherbrooke, Que. Incorporators — Leland Drew Adams, Charles Herbert Maxey, of Oaklands, Cal., and John Perley Wells, of Sherbrooke, Que.

The Capital Electric Co. has been incorporated at Ottawa, with a capital of $40,000 to carry on business as iron-founders and machinists at Ottawa, Ont. Incorporators, Robert P. Moodie, Edward Thomas Headley and Bernard Gillies, all of Ottawa.

The Russell Fireproofing Co. has been incorporated at Ottawa with a capital of $250,000 to manufacture fireproofing materials, brick and tile, etc., at Russell, Ont. Incorporators, Andrew Walker, Hiram Kenney and James A. Cochrane, all of Russell, Ont.

Marine

Port Arthur, Ont.—The steamers Turret Cape, Turret Chief and Paliki are to be added to those formerly on the Great Lakes and now doing service on the Atlantic. All were ocean-going vessels before being brought to the lakes.

Steamer Condemned.—The steamer Helen R., plying between North Bay and the French River, has been condemned by Government officers, and is now laid up at the wharf, North Bay. She failed to carry the necessary lifeboats and belts as required by law.

Submarine Destructiveness.—Lloyd's official report for the quarter ended August 12 gives the loss to British shipping by submarines as 77 vessels. At that fearful rate, says the Wall Street Journal, there won't be anything left of the British merchant marine in 200 years.

Montreal, Que.—After spending five weeks in dry dock at St. John's, Newfoundland, the steamer Polan Hall arrived in Montreal on September 2. In a dense fog the vessel ran into a short cliff, about 100 feet high, just north of Cape Race, and pounded on a rocky bottom for an hour before being relieved.

New Brunswick Shipping Situation.—The announcement has been made that the British deck-load law will not come into operation this year until November 15. This will mean that steamships with summer deck-loads will be able to clear from New Brunswick ports up to November 1 at least. This extension will mean a period of greatly increased activity at St. John. So far this year the summer shipping business has been ahead of last year.

Montreal, Que.—The master of the steamer Alexandria, Captain William Bloomfield, was justified in his action in beaching the vessel, in a judgment given on September 3, by Captain L. A. Demers, Dominion Wreck Commissioner. The Alexandria was lost in a hurricane off Scarboro Bluffs, near Toronto, on August 3. The master ran her on the beach and she went to pieces. The commissioner finds no fault with this ac-

tion, and exonerates everybody else in connection with it.

Personal

R. W. Hendry, of Hendry, Ltd., has been appointed managing director of the Halifax and Sheet Harbor Steamship Co., Halifax, N.S.

R. J. Cluff has resigned his position as general manager of Steel & Radiation, Ltd., Toronto, to engage in the manufacture of war munitions.

Geo. L. Williams, of Brampton, Ont., has taken over the management of a shoe factory in Toronto and left for that city last week to assume control.

Charles A. Murton has been appointed sole representative in Hamilton, Ont., of the Ahern Safe Co., Montreal, the well-known makers of fire-proof safes, vault doors, etc.

Hon. Finlay McDiarmid, Minister of Public Works, and Hon. I. B. Lucas, Attorney General for Ontario, who have been touring Western Canada, have returned to Toronto.

John L. Feeney, of Fredericton, N.B., has been appointed by the Provincial Government of New Brunswick to the position of road engineer in charge of all important highway improvements.

John Knox, treasurer of the Dominion Power & Transmission Co., died at his home, 15 Robinson street, Hamilton, Ont., on Aug. 31. The late Mr. Knox was born at Kilwinning, Ayrshire, Scotland, and came to this city 32 years ago.

Giles S. Ransom died at his late residence, 386 Indian Road, Toronto, Ont., on Aug. 31, at the age of 62. The late Mr. Ransom was born in Buffalo, N.Y., in 1853, where he received his education. About 40 years ago he came to Toronto, where he has resided ever since. For the past 27 years he had been president of the Toronto Furnace & Crematory Co.

Trade Gossip

Hespeler, Ont.—The employees of the R. Forbes Co. have raised $750 towards the purchase of a machine gun.

The Dominion Canners, Ltd., whose head office is at Hamilton, Ont., have taken over the British-Canadian Canning Co.

The North Bay Iron Works, of North Bay, Ont., have secured a contract from the Sturgeon Falls Pulp & Paper Co. to supply all castings and machine work for a year. The contract will amount to at least $25,000.

The Northern Canada Power Co. have decided to increase their plant in Porcupine to an extent that will cost them at least one million dollars.

The A. B. Jardine Co., Hespeler, Ont., have sent a cheque for $300 to the local machine gun fund on behalf of the company and employees.

Munitions Manufacture.—It is reported that 10,000 brass cartridge cases for shrapnel shells are being turned out each day in the Montreal district.

Customs Notice. — Steam towing winches are now manufactured in Canada by the Corbet Foundry & Machine Co., of Owen Sound, Ont., and are, therefore, not entitled to entry under tariff item No. 470.

The Process Engineers, Ltd., of Montreal, Que., have leased for three years the antimony mines owned by the Canadian Antimony Co. at Lake George, York County, N.B., about 25 miles from Fredericton, and operations will be commenced immediately.

The Imperial Oil Co., Toronto, announce that married men among the employees of the corporation who have enlisted or may enlist for active service overseas will receive half pay and single men quarter pay until the end of the war. In addition, the company will hold the men's positions open for them on their return.

Montreal, Que.—A comprehensive scheme is on foot to erect a large exhibition building or "Palace of Industry" for the holding of trade exhibitions in the Montreal area, and in particular for a large industrial fair in the spring of 1917, according to a statement by T. C. Kirby, manager of the Montreal Automobile Trade Association, Ltd.

Ontario Nickel Commission. — The chairman of the new Ontario Nickel Commission, George T. Holloway, London, Eng., has arrived in Canada and has already met his colleagues, Prof. Miller, Provincial Geologist; T. W. Gibson, Deputy Minister of Mines, and Macgregor Young, K.C. The first steps of the Commission will be a thorough examination of the Sudbury nickel industry, to be followed by a visit to the big New Jersey refining plants, where most of Ontario's nickel ore is treated. One of the Commission's duties will be to prepare an estimate of the extent of Ontario's nickel ore bodies, which would be necessary as a basis for permanent taxation policy.

Collingwood Shipbuilding Co.—The annual general meeting of the Collingwood Shipbuilding Co. was held on Sept. 1. The usual financial statements and balance sheets were presented and we under-

stand were of a satisfactory character, considering the dull period of the first half of the company's year. The following were elected directors: Thos. Long, Toronto; Capt. Alex. McDougall, Duluth; S. H. Lindsay, Collingwood; P. M. Campbell, Collingwood; H. B. Smith, Owen Sound; S. Dyment, Barrie; M. P. Byrnes, Collingwood; T. P. Long, Collingwood. At a subsequent meeting of the directors, the following officers were elected: President, Thos. Long; Vice-President, Capt. Alex. McDougall; Secretary-Treasurer, S. H. Lindsay.

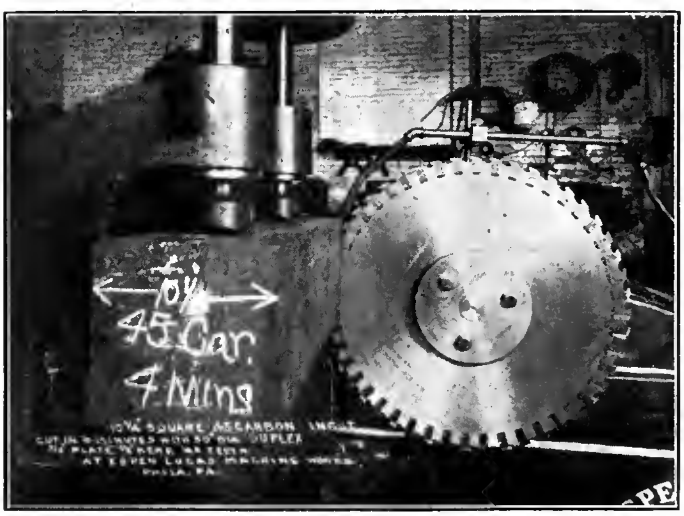
Heavy Exports Anticipated.—Inquiry of shipping companies brings responses to the effect that there is a big demand for grain for all periods from now to the close of navigation, and that this demand extends to all other classes of cargo as well. That is to say, large quantities are demanded of flour, cheese, deals, and provisions, as well as of manufactured articles of every description. One feature in the export trade, which of itself makes this a remarkable year as compared with all past ones in the history of the port of Montreal, is the export of large quantities of steel in billets, tubes, bars and all kinds of shapes. In previous years it has been rather a case of importing such articles than exporting them. Apples will also commence to move freely about the middle of September. With these cargoes in prospect the various steamship lines look for a very heavy export business this fall.

Catalogues

"Burd" Piston Rings.—Bulletin describing the "Burd" high compression rings, made by the Burd High Compression Ring Co., Rockford, Ill. The principal features of this ring are dealt with at length, accompanied by illustrations showing the general construction.

Machinists' Tools.—The National Machinery and Supply Co., Hamilton, Ont., have issued a new catalogue dealing with machinist and woodworker tools, such as vises, planes, handscrews, clamps, etc. The catalogue is fully illustrated and prices are included for each product.

Dixon's Graphite Brushes is the title of a booklet, which explains how the characteristic lubricating qualities of graphite are utilized for reducing commutator troubles to a minimum. The entire booklet is recommended for careful consideration, especially page 3, where the advantages of graphite are clearly set forth. A copy of the booklet may be obtained free upon request from the Joseph Dixon Crucible Co., Jersey City, N.J.



A Chain of Evidence is the title of a publication, No. 13, recently issued by the Morse Chain Co., Ithaca, N.Y., illustrating and describing the "Morse" silent chain and showing a few applications in textile mills. The illustration shows several "Morse" chain drives, each being accompanied by particulars of the drive.

Steel Sheet Piling.—Bulletin No. 108 describes fully arched web, straight web, centre flange protected and plate types of steel sheet piling made by the Lackawanna Steel Co., Lackawanna, N.Y. A number of excellent half-tones show many interesting installations featuring the wide scope of this product. Cross sections are shown of the various types, together with weights and dimensions, while an efficiency table is also included. A brief description accompanies each illustration explaining the principal features of the work shown in the view. The catalogue contains much interesting and useful information on steel piling and its application. The general agents for Canada are the H. A. Drury Co., Ltd., Montreal, Que.

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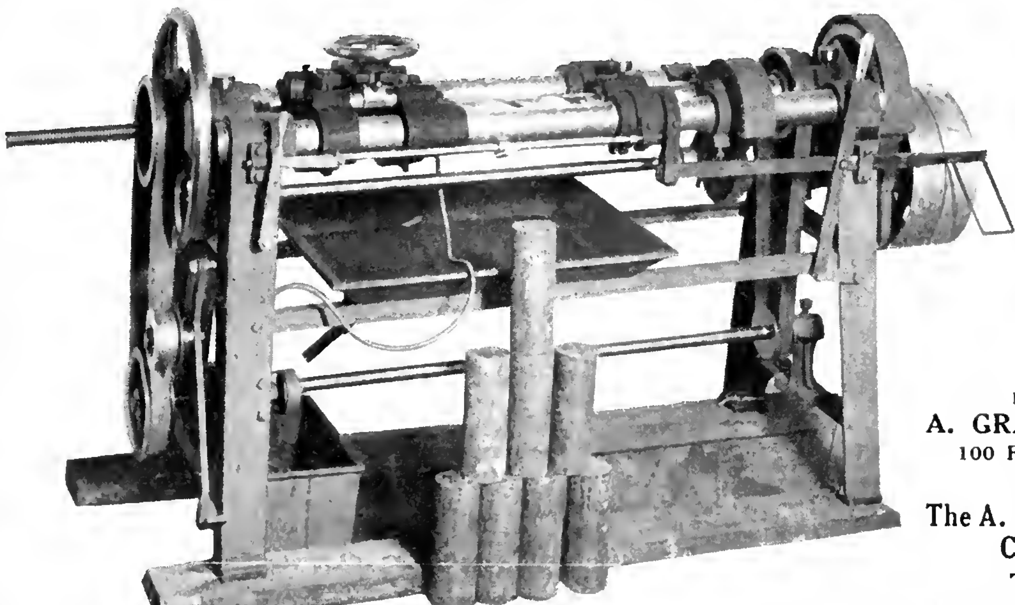

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Toronto, Winnipeg, St. John, N.B.

Tenders for Scrap.—Sealed tenders for the purchase of a quantity of scrap metal at the Dominion Arsenal, Quebec, will be received up to noon of Thursday, the 23rd day of September, 1915. The quantities are approximately as follows:

	Lbs.
Brass, etc.	16,000
Charger steel	81,120
Steel, tool, lumps	13,950
Steel, mild, lumps	129,232
Turnings	72,074
Cast iron	183,848

The prices should be for delivery, ex stores, Dominion Arsenal, Quebec, material to be removed within 30 days after acceptance of tender. All the scrap is loose, and information required may be obtained from the Superintendent, Dominion Arsenal, Quebec; or Department of Militia and Defence, Ottawa.

Trade Gossip

The Canadian Iron Foundries, Ltd., Montreal, have been awarded a contract for the supply of cast iron pipe to the city of Hull, Que.

St. John's, Nfld.—W. F. Mackay has made application to the City Commissioners for permission to erect a small smelting plant near the west end water front.

The General Supply Co. of Canada, Ottawa, Ont., have opened an office at 408 McGill Building, Montreal, in charge of G. W. Robb. They handle railway supplies, concrete machinery, pumps, etc.

Smith's Falls, Ont.—M. G. Henniger and J. S. Gould, of this town, have purchased an interest in the Rideau Power Co., of Merrickville, Ont. It is understood that the policy under the new arrangement will be to develop power to its fullest extent.

Pit Props to England.—If the war continues Newfoundland expects to ship one million cords of pit props next season for English collieries. During the season just passed, fifty steamers took cargoes running from 5,000 to 20,000 cords each. This was all that was cut last winter.

Canada Iron Corporation—It is announced authoritatively that the affairs of the Canada Iron Corporation, which went into liquidation about two years ago, and the assets of which were taken over by the Canada Iron Foundries, Ltd., will be wound up about the end of the present month.

Steel Billets Higher.—It is reported from Pittsburgh, Pa., that the constantly increasing demand for shrapnel bar is causing the price of steel billets to jump, until a maximum limit has been reached, and buyers in the open market are declaring quotations to be prohibitive.

Nickel Commission at Work.—The Ontario Nickel Commission got down to business on September 10, when it paid a visit to the smelters at Deloro, Ontario. The commission will form its own itinerary, having been given almost carte blanche by the Hon. G. Howard Ferguson, Minister of Lands, Forests, and Mines.

Canadian Gen. Electric Co.—While the ordinary trade of the Canadian General Electric Company has been a little slack during the year so far, war orders have enabled it to maintain its strong financial position and keep up the dividend on the basis that has persisted for some 25 years. The war orders were officially stated recently to be of considerable proportions.

Niagara Falls, Ont.—Engineers of the Ontario Hydro-Electric Commission have just completed a survey for an Ontario Government power-house on the Smeaton farm between Queenstown Heights and Niagara Falls, Ont. It is planned to use the surplus waters of the Welland Canal to develop 300,000 horse-power, carrying the water to the generating station through a canal running from the Chippewa creek.

The Transmission Ball Bearing Co., Buffalo, N.Y., has been incorporated with a capital stock of $100,000 to manufacture ball bearings for factory transmission and for engines, motors and trucks. The directors of the new company (which is the United States branch of the Chapman Double Ball Bearing Company of Toronto) are W. J. Murray and J. P. Beatty, of Toronto, and W. Morse Wilson, of Buffalo. The office of the company is at 1407 West Avenue, Buffalo, N.Y.

U. S. Munitions Export.—American exports of war supplies are increasing enormously now that converted munitions plants are getting into full swing. Figures made public by the Bureau of Foreign and Domestic Commerce show that shipments of horses, mules, automobiles, aeroplanes and explosives, all classed as war supplies, aggregated nearly $50,000,000 in July. The principal increase compared with June exports was in the classification of "all other explosives," including shells and other ammunitions of special manufacture, which jumped from $5,911,929 to $9,329,303. Automobiles, the only item to show a material decrease, dropped from $14,500,000 to $11,000,000.

Steel Co. of Canada.—Figures of earnings of the Steel Co. of Canada, for July, are not yet available, but it is learned that they were well in excess of the June figures, which indicated profits at the annual rate of 21 per cent. on the common stock. In the first half of 1915,

the company did a gross business of about $6,400,000. Its best year's gross was 1912, when orders totalling nearly $16,000,000 were filled. Gross in the second half of 1915 should be at least $10,000,000, which would make the year a record one. Net earnings for 1915 are conservatively estimated at about $3,200,000, this estimate being based on suppositious earnings of $400,000 monthly for the second half.

Canadian Car & Foundry Co.—Advices from New York state that negotiations for the purchase by the Russian Government from the Canadian Car & Foundry Co. of 3,000,000 sharpnel and high explosive shells at a cost of $52,000,000 have been virtually completed. The information was given out at the New York office of the company. Canadian Car & Foundry have already received contracts from the Russian Government valued at nearly $100,000,000. The contract calls for the delivery of the ammunition by April of next year and part of the work will be sublet. Russian funds, it is understood, in Wall Street, have been sent to New York and Canada to cover payment. The contract, it was announced, covers orders for additional shells just as soon as the present ones are turned out.

Personal

Frank Morgan, for 29 years with the Cowan Co., Galt., has been appointed manager of the Dominion Bronze Co., Preston, Ont.

Charles Hothan, of the Brantford Motor Truck Co., has completed a new bayonet and automatic wire entanglement cutter.

E. J. Chamberlain, president of the Grand Trunk Railway, and party of officials, are on their way to Prince Rupert, B.C., on their annual tour of inspection.

Edward Cahill, general manager of the Winnipeg branch of the Gray-Campbell, Ltd., makers of mill equipment and machinery, Chatham, Ont., died suddenly at Hanley, Sask., on September 1. He was 55 years of age.

Hon. T. W. Crothers, Minister of Labor, has left Ottawa on a trip to Western Canada. He will go through to the coast and up as far as Prince Rupert. The Minister of Labor will stop off at all the principal cities and inquire into industrial conditions. At Vancouver he will attend the Dominion Trades and Labor Congress.

The G. H. Tod Co., engineers, late of Manning Chambers, Toronto, have transferred their business to 10-20 Croft Street, city, where a machine shop has been equipped for carrying on a general

engineering business. The company will continue to handle "Bennis" stokers and "Ashworth-Parker" engines, etc., and will in addition be in a position to build machinery and tools for the trade.

D. A. Thomas, the special representative of the British Minister of Munitions, left Ottawa on September 9 for New York. He has completed his work in Canada for the time at least, but will, it is understood, remain in New York. Mr. Thomas' inspection of the munition manufactories in Canada and his conferences with Canadian manufacturers have resulted satisfactorily. He has had several conferences with Sir Robert Borden since the latter's return from England.

Capt. P. M. Campbell, a director of the Collingwood Shipbuilding Co., died at Collingwood, Ont., on September 10, at the age of 69. Capt. Campbell was for many years commodore of the Great Northern Transit Co. fleet, which was later merged into the Northern Navigation Co. He was also one of the founders of the Georgian Bay Navigation Co. Capt. Campbell was one of the original directors of the Collingwood Drydock Co., which ultimately became the Collingwood Shipbuilding Co., of which he was a director up to the time of his death.

D. M. Medcalf, chief inspector of steam boilers for the Province of Ontario, has left for a tour of the Western provinces to confer with the heads of the boiler inspection departments of the Provinces of Manitoba, Saskatchewan, Alberta and British Columbia, with regard to the standardization of rules covering boiler construction and inspection, and to arrange for boilers built under Ontario regulations being accepted by the other provinces. Mr. Medcalf will also visit the Panama-Pacific Exhibition at San Francisco, Cal.

Sir William Cornelius Van Horne, K.C.M.G., at one time president of the C.P.R., died in Montreal on September 11, following a comparatively brief illness. Sir Wm. Van Horne was born at Joliet, Ill., on February 3, 1843, the son of a lawyer. He entered the railway service as a telegraph operator on the Illinois Central Railway in 1857, served in various capacities on the Michigan Central Railway 1858-64, for three years as train despatcher. He was superintendent of telegraphs for a year and divisional superintendent for three years while with the Chicago and Alton Railway, 1864-72; was general superintendent of the St. Louis, Kansas City and Northern Railway, 1872-4; general manager of the Southern Minnesota Railway, 1874-8, and president 1878-9; general manager of the Canadian Pacific

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USE THE

"BRIGGS"

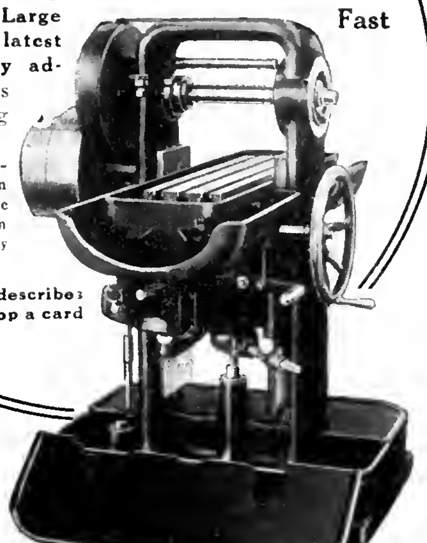
The Briggs Miller handles work no other machine of its size can touch. It is a manufacturing machine. On account of its rigid construction it will produce accurate work when running at a high rate of speed and feed.

Fast

The Base Tank and Large Gear Pump is the latest addition to its many advantages. Tank holds 20 gallons of cutting lubricant.

Pump never requires priming and will deliver ten gallons per minute to the cutters, keeping them cool when run at very high speed.

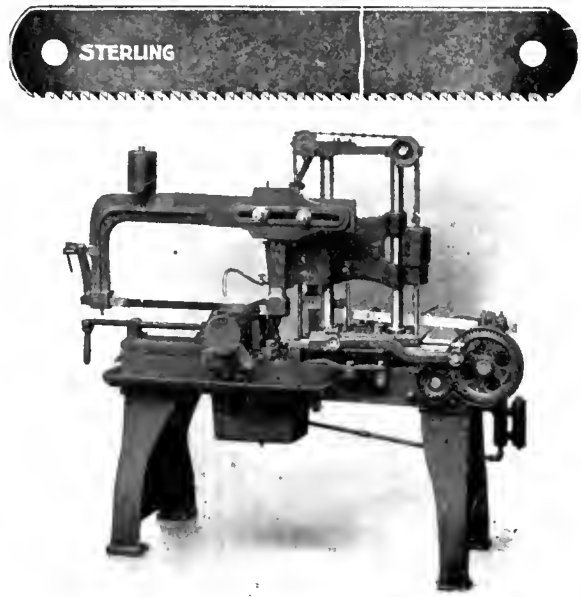
Our booklet describes fully. Drop a card for it.



Gooley & Edlund
Inc.
Cortland, U.S.A.

Foreign Agents: Allied Machinery Company of America, France, Belgium, Italy, Switzerland, Russia, Scandinavia. C. W. Burton, Griffiths & Co., London, Manchester and Glasgow. Barandiaran, Metivier, Gazeau & Cia, San Sebastian, Spain.

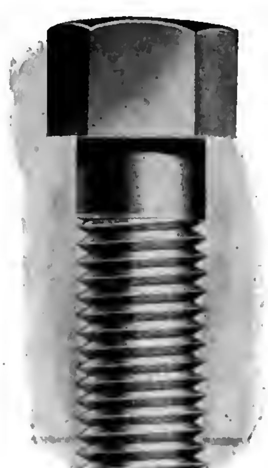
"STERLING"
HACK SAWS



MANUFACTURED BY

DIAMOND SAW & STAMPING WORKS
BUFFALO, N.Y., U.S.A.

ACCURACY



Because a small diameter screw enters the tapped hole is no guarantee that it fits properly.

The pitch may be long or short, and therefore cause resistance, but be a poor fit.

Cap and Set Screws should fit all the way like a shaft in its bearing.

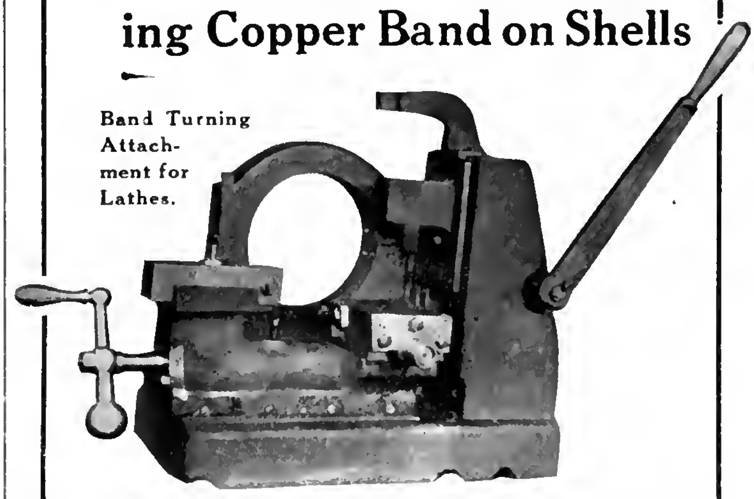
"Galt Screws do. Try them."

Specialists in Cap and Set Screws.

THE
GALT MACHINE SCREW CO.,
LIMITED
GALT, ONTARIO

A Time-Saver for Turning Copper Band on Shells

Band Turning Attachment for Lathes.



This attachment will fit any engine lathe, and with its use you can turn the copper band on Shrapnel Shells down to size required and burnish them *all in one operation.*

With this device we will guarantee an output of

50 Turned Copper Bands per Hour

Used with a specially constructed steel chuck, casting of which can be finished on the lathe on which the attachment will be used.

Castings are supplied by us.

WRITE FOR PARTICULARS.

LYMBURNER LIMITED
5-15 Commissioners St. Montreal, P. Que.

Railway, 1882-4, carrying the road to completion; vice-president 1884-8, president 1888-1899, and chairman of the board of directors 1899-1910, after which he continued on the directorate. In recent years he took a leading part in railway development in Cuba, and he has been interested in many large railway, industrial and financial enterprises.

Catalogues

Forcing Presses.—Catalogue No. 92 deals with the line of hydraulic forcing presses made by the Watson-Stillman Co., New York. A number of presses for various purposes are described and illustrated, making altogether a very complete line. Included is a copper hand-press for shell work.

"**Wrought Iron Railing,** Entrance Gates and Wire Fencing" is the title of a 64-page handsomely illustrated catalogue issued by the J. W. Fiske Iron Works, 78-80 Park Place, New York. This catalogue also includes outside lighting fixtures, mesh wire work for tool and stock room enclosures, and ornamental iron grille work.

Norton Ball Bearing Jack made by A. E. Norton, Ltd., Coaticook, Que. Catalogue No. 28 describes a complete line, featuring the various types of ball-bearing jacks. Tables give the principal dimensions, weight and list price of each size, and are accompanied by illustrations of the different types and repair parts. Interested readers may obtain copies by writing the company.

The Dodge Manufacturing Co., Toronto, have published a report compiled by Professor Price of Toronto University on the properties of wood-split and iron pulleys. The report records a scientific test showing loss from slippage of belts on metal pulleys and the comparative advantages of wood-split pulleys. It also describes the tests in detail and contains a considerable amount of useful information on power transmissions by belts and pulleys. A number of interesting curve and tabulated sheets are included in the report.

Link-Belt and Sprocket Wheels.—The Link-Belt Co., Philadelphia, Pa., are distributing Section A of general catalogue No. 110, dealing with the original "Ewart" detachable link-belt and sprocket wheels. A large number of full-size cuts are shown of standard and special sizes of "Ewart" link-belts and a number of attachments are also illustrated. The catalogue also contains a brief description and price list of attachments, also price lists of sprocket wheels and "Ewart" detachable link-belts.

lower. Antimony has declined 2c and is quoted at 38c per pound.

Aluminum.—There is a considerable increase in the demand for aluminum and the scarcity continues. Quotations have advanced 2c, and are strong at 40c per pound.

INTERNATIONAL NICKEL COMPANY

THE Wall Street Journal says that the International Nickel Co. is receiving and taking care of enormous orders for nickel, its by-products and copper without difficulty.

Nickel is now being used in greater quantities than ever before, due to the abnormal demand for automobiles, manufactured steel products and submarines. The latest use for nickel is in the new electric batteries for submarines, invented by Thomas A. Edison, which will prevent the generation of chlorine gas. In this instance nickel supplants lead.

Another source of increased revenue is the high price of copper. The company's ore recovery is estimated to be about 70 per cent. nickel and 30 per cent. copper. In a year many millions of pounds of copper are produced and sold.

The company owns the most extensive known existing nickel ore deposits. Its patented nickel lands in Ontario, Canada, cover 100,000 acres, and in addition to this the company owns the Town of Copper Cliff, where it has an up-to-date smelting plant. It also owns the shares of the Societe Miniere Caledonienne of New Caledonia, which company owns extensive nickel lands. These lands, it is estimated, will furnish the company with at least 60 years' ore supply.

Earnings during the months of June, July and August, according to well-informed interests, were at the rate of between 25 per cent. and 30 per cent. a year on the common stock. Last year earnings were equal to 13.31 per cent. on the stock.

The company is now paying dividends at the rate of 20 per cent. per annum, having paid 5 per cent. in June and the same tmount in September. This rate will be continued during the remainder of the year, and interests close to the company say it is not unlikely that an extra cash or a stock disbursement will be made this year.

NEW COMMISSION ON PRODUCTION

THE names of the new commission decided upon by the Dominion Government for the purpose of investigating and reporting upon conditions of production, transportation and employment in Canada will be announced shortly. This is the commission of which the late Sir William Van Horne was to have been chairman. His death will necessitate the selection of a new commissioner conversant with transportation and kindred subjects, as the railway facilities of the Dominion provide one of the most important aspects of the problem which is to be solved, particularly the question of a proper system of branch lines to support the great East and West trunk lines already constructed.

The Order-in-Council provides for an investigation of matters relating to scientific production, increased acreage and improved methods, the existing facilities for marketing both at home and abroad, the desirability of providing proper highways and cold storage facilities and the importance of co-operative action by producers. The question of unemployment and immigration, particularly with regard to the expected influx when the war is over, is to be reported upon, and a method devised for so handling this immigration as to promote the cultivation of the great areas of idle land in the Dominion. Questions affecting Canada's position as a borrowing country are also embraced in the Order-in-Council.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Tweed, Ont.—Wm. Garrett & Sons foundry and machine shop has been taken over by S. G. Way of Belleville, Ont.

Halifax, N.S.—The Imperial Oil Co., Montreal, is contemplating the erection of an asphalt and fuel oil refinery at Halifax, to cost $400,000.

Toronto, Ont.—W. H. Banfield & Sons have applied for permission to erect an addition to their shell factory on Pape avenue. The addition is estimated to cost about $1,500.

New Westminster, B.C.—The Schaake Co. will install a machine shop at the former Schaake Machine Works. The shops will manufacture machinery for shingle mills, sawmills and canneries, and will also have a capacity of 100 18-lb. high explosive shells a day. Henry Schaake is president.

Electrical

Southampton, Ont.—The town council contemplate spending $13,000 on the installation of a hydro-electric system.

Toronto, Ont. — The Toronto Hydro-Electric Commission will build a sub-station at the corner of Gerrard street and Carlaw avenue, to cost $60,000. Transformers and other equipment will be required.

Municipal

Bridgen, Ont.—It is proposed to increase the capacity of the electric light plant in this village.

St. Andrews, N.S.—A new pumping station will be built. The total cost, including equipment, to be $35,000.

Brigden, Ont.—Extensions to the electric light plant are contemplated. A by-law will be voted on to raise $3,500 for the purpose.

Palmerston, Ont.—The town council has signed a hydro-electric contract for 200 h.p. at $40.82, and the Commission undertakes to make connections by January 1 next.

Markham, Ont.—It is proposed to spend $20,000 on the construction and installation of a modern waterworks system. A by-law will be voted on by the ratepayers on Oct. 2.

Georgetown, Ont.—A by-law will be voted on by the ratepayers on Sept. 27 to raise $30,000 to assist by way of a bonus the Glass Garden Builders, Ltd., who propose establishing a factory here.

Orangeville, Ont.—Two by-laws have been passed by the ratepayers, one to authorize a contract with the Hydro-Electric Commission, and another to raise $33,000 to provide for a municipal distribution plant.

Chesley, Ont.—It is proposed to spend $9,000 for the purchase of portions of M. A. Halliday's electric light plant, and $13,500 to provide for the cost of an electric plant and works to transmit and distribute electric power to be supplied by the Hydro-Electric Power Commission.

Oshawa, Ont.—The ratepayers last Monday voted on and carried by a vote of 839 to 75 a by-law providing for the giving of 140 acres of land to David Maxwell, of Toronto, also guaranteeing $60,000 bonds of the company. Mr. Maxwell proposes to erect a steel plant and rolling mill on the property, valued at $350,000. He will have till the end of 1916 to perform his part of the agreement.

Stratford, Ont.—The Stratford Public Utilities Commission has awarded the contract for a standpipe to the Canadian Chicago Bridge & Iron Works at a cost of $24,800. The pipe purchased, the necessary accessories, together with the labor, will cost altogether $37,250, and with the remainder of the $50,000 to be derived by the Commission fromm the sale of debentures, two gasoline engine-driven pumps will be purchased at a cost of $8,000. Each pump is to have a capacity for pumping 1,000 Imperial gallons per minute.

ALLIES PURCHASING AGENTS

The Trade and Commerce Department, Ottawa, has published the following list of purchasing agents for military purposes for the allied Governments:

International Purchasing Commission, India House, Kingsway, London, Eng.

French.—Hudson Bay Co., 56 McGill Street, Montreal; Captain Lafoulloux, Hotel Brevort, New York; Direction de l'Intendence Ministere de la Guerre, Bordeaux, France; M. De la Chaume, 28 Broadway, Westminster, London.

Russian.—Messrs. S. Ruperti and Alexsieff, care Military Atache, Russian Embassy, Washington, D.C.

General Industrial

Hamilton, Ont.—The Hamilton Cotton Co. will build an addition to their factory.

Wallaceburg, Ont.—The Wallaceburg, Ont., glass works are building an addition.

Rimouski, Que.—Price Bros. & Co. new paper mill was destroyed by fire recently. The damage is estimated at $3,000.

Montreal, Que.—C. H. Johnson & Sons Ltd., will build an addition to their factory at a cost of $3,000.

Bridgeburg, Ont.—The King Separator Co., Buffalo, N.Y., will erect a plant at Bridgeburg, for assembling parts of its Canadian product.

New Glasgow, N.S.—The Rhodes Curry Co. have the contract for building an extension to the Nova Scotia Underwear Co. factory at Eureka, N.S.

Windsor, Ont.—The Canadian Salt Co. is doubling the capacity of its plant here for the manufahture of caustic powder and bleaching powder.

Edmonton, Alta.—The Canadian Linen Fibre Co., capitalized at $3,000,000, has been organized here. It is proposed to establish a plant to take care of all the flax grown in the district. G. W. Hunt, of Calgary, is interested in the proposition.

Madoc, Ont.—The Elkhorn Lime Co., Ltd., contemplate installing a battery of four kilns for the manufacture of hydrate and bulk lime. The plant will have a capacity of sixty tons of lime per day. In connection with this industry there will also be established a barrel factory. C. W. Sharpe is president of the company.

HILL, CLARKE & CO.
MACHINERY MERCHANTS
OF
CHICAGO

THE SIGN OF DEPENDABLE

Re-Manufactured Machinery

FOR QUICK SHIPMENT

Partial List of the Largest Stock in the World

ENGINE LATHES

1—4" x 5' Fitchburg Lo-Swing.
1—10" x 3½' Seneca Falls.
1—10" x 5' Reed.
1—10" x 5' Pratt & Whitney, T. A., O.P., Draw Bar.
1—12" x 5' Reed.
3—12" x 5' Fay & Scott.
1—12" x 5' Hendey, T. A., O. P., Q.C.G.
1—13" x 5' Barnes.
1—13" x 6' Sebastian.
1—13" x 6' Willard.
1—13" x 8' Willard.
1—14" x 6' Lodge & Davis.
1—14" x 6' Flather.
1—14" x 6' Hendey.
1—14" x 6' Lodge & Davis, T.A.
1—14" x 6' Lodge & Shipley.
1—14" x 6' Reed.
1—14" x 6' Prentice, Q.C.G.
2—14" x 6' Cisco, Q.C.G.
1—14" x 6' Hendey, T.A., Q.C.G.
1—14" x 8' Lodge & Shipley, Pat. Hd., Q.C.G.
1—15" x 6' Seneca Falls, Q.C.G.
1—15" x 6' Flather.
1—15" x 6' LeBlond.
1—15" x 6' Davis.
3—15" x 6' Von Wyck, T.A.
1—15" x 6' Von Wyck, Q.C.G.
1—15" x 6' Walcott.
1—15" x 6' Whitcomb Blaisdell.
1—15" x 6' Whitcomb Blaisdell, Q.C.G.
1—15" x 6' Walcott.
1—15" x 6' Von Wyck.
1—16" x 6' Forsaith.
1—16" x 6 Reed.
1—16" x 6' Blaisdell, T.A.
1—16" x 6' American.
1—16" x 6' Flather.
2—16" x 6' Walcott.
1—16" x 6' Pratt & Whitney.
1—16" x 8' Porter.
1—16" x 8' Flather, Mot. Drive.
1—16" x 8' Flather, Turret.
1—16" x 8' Lodge & Shipley, Pat. Hd., Q.C.G.
1—16" x 8' Lodge & Shipley, Q.C.G.
1—16" x 8' Lodge & Shipley, Mot. Drive, T.A., Q.C.G.
1—16" x 8' Putnam.
1—16" x 8' Greavea & Klusman.
1—16" x 8' Beaman & Smith, Turret.
1—16" x 8' American.
1—16" x 8' Silk-Anderson.
1—16" x 10' Von Wyck, T.A.
1—16" x 10' Davis.
1—17" x 6' Blaisdell.
1—17" x 6' Rockwell.
1—17" x 6' Blaisdell.
1—17" x 8' Greaves & Klusman, T.A., Turret.
1—17" x 8' Greaves & Klusman, Mot. Drive, T.A.
1—17" x 8' Prentice, Q.C.G., Turret.
1—17" x 10' Cincinnati.
1—17" x 10' Silk-Anderson.
1—18" x 6' LeBlond, Q.C.G., Turret.
1—18" x 6' Whitcomb Blaisdell.
1—18" x 8' Reed.
1—18" x 8' Walcott.
1—18" x 8' Wheeler.
1—18" x 8' Davis & Egan, T.A.
2—18" x 8' Bradford.
1—18" x 8' American, T.A., Q.C.G.
1—18" x 8' American, Q.C.G.
1—18" x 8' Flather.
2—18" x 8' Whitcomb Blaisdell.
1—18" x 12' Davis & Egan.
1—18" x 12' Champion.
2—19" x 8' Rahn.
2—19" x 8' Silk-Anderson.
1—19" x 8' Greaves & Klusman, Turret.
1—19" x 10' LeBlond.
1—19" x 14' Bridgeford, double axle.
1—20 x 8' Rahn.
1—20" x 8' Flather.
1—20" x 8' LeBlond, heavy duty, Q.C.G.
1—20" x 12' Porter.
1—21" x 10' Fitchburg.
1—21" x 10' Schumacher & Boye.
1—21" x 14' Flather.
1—21" x 16' Flather.
1—21" x 16' LeBlond.
1—22" x 8' Blaisdell.
1—22" x 8' American, G. H. Turret, Q.C.G.
1—22" x 10' Schumacher & Boye, T.A.
1—22" x 10' Schumacher & Boye.
1—22" x 10' Perkina.
1—22" x 12' Economic.
1—24" x 12' Economic, Q.C.G.
1—24" x 12' Schumacher & Boye.
1—24" x 16' Schumacher & Boye.
1—24" x 16' Davis & Egan
1—25" x 10' Bradford.
1—25" x 12' Lodge & Shipley, Turret, Q.C.G.
2—25" x 14' Bradford.
1—25" x 20' Muller.
1—26" x 12' Schumacher & Boye.
1—26" x 12' Gleason, T.A.
1—28" x 16' Fay & Scott.
1—30" x 14' Blaisdell.
1—30" x 16' Reed.
1—32" x 10' Bradford.
1—32" x 12' American.
1—36" x 12' Fifield.
1—36" x 12' Schumacher & Boye.
1—38" x 16' Fifield.
1—42" x 12' Putnam.
1—46" x 16' Putnam.
1—60" x 16½' Fitchburg.

HAND TURRET AND SCREW MACHINES

1—Brown & Sharpe, No. 1 Monitor.
1—Brown & Sharpe No. 1 Screw Machine.
1—Flather, 13" Turret.
1—Wood No. 2, Monitor.
1—Gisholt, 13" Turret.
1—Garvin 14" Turret.
1—Pratt & Whitney, 14" Monitor.
1—American 15" Fox Lathe.
3—Pratt & Whitney, 16" Monitor, F.B.G.
4—American No. 2 Fox Lathes.
1—Lodge & Davis 18" Cabinet.
1—Springfield, 18" Cabinet.
1—Garvin, No. 22½.
1—Gisholt, 21" Turret, R.T., T.A.
5—Potter & Johnson, 22".
2—Gisholt 24", R.T., T.A.
1—Eddy, 36".
3—Pratt & Whitney, ⅝".
1—Warner & Swasey, ⅝".
1—Bardons & Oliver, 11-16".
2—Bardons & Oliver, ¾".
2—Pearson, ¾".
2—Garvin, ⅞".
1—Bardons & Oliver, 15-16".
1—Garvin, 1".
1—Foster, 1".
1—Wood, 1".
2—Bardons & Oliver, 1".
2—Bardons & Oliver, No. 2 Monitor.
1—Pratt & Whitney, 1".
1—Pearson, 1⅛".
1—Wood, 1¼".
1—Pearson, 1¼".
1—Dreses, 1½".
1—Brown & Sharpe, 1¼".
1—Pratt & Whitney, 1½".
1—Lodge & Davis, 1½".
1—Bardons & Oliver, 1¾".
1—Davis & Egan, 2".
4—Bardons & Oliver, 2".
4—Warner & Swasey, Hol. Hex.
1—Pratt & Whitney, 2".
2—Jones & Lamson, 2", Cone.
2—Jones & Lamson, 2⅝", Cone.
1—Jones & Lamson, 3" x 36", Geared.
2—Warner & Swasey, No. 8, 3⅝".

AUTOMATIC TURRET AND SCREW MACHINES

1—No. 0 Hartford Automatic.
1—No. 1 Acme Automatic.
2—2" Cleveland Automatic.
1—2¾" Cleveland Automatic.
7—No. 53 National Acme—4-spindle.
4—No. 54 National Acme—4-spindle.
1—No. 55 National Acme—4-apindle.
1—No. 56 National Acme—4-spindle.

SENSITIVE AND UPRIGHT DRILLS

Over 100 items from 10" sensitive to 42" upright.

MULTIPLE DRILLS

12 items.

RADIAL DRILLS

29 items, 2' to 6½' Arm.

VERTICAL BORING MACHINES

5—Baker Bros., 20".
1—Baker Bros., 20", 2-spindle.
2—Bickford, 24".
3—Foot-Burt, 2-spindle.
2—Foot-Burt, 2-spindle cylinder.
2—Foot-Burt, 4-spindle.
1—Moline, 4-apindle.
1—Bullard, 24", Vertical Turret.
1—E. J. Flather, 30".
1—Baush, 30".
1—Bullard, 32".
4—Bullard, 34".
2—Rogers, 34".
2—Brown & Sharpe, 36".
1—Baush & Harris, 37", 2-Hds.
1—King, 42", 2-Hds.
1—Colburn, 48", 2-Hds.

HORIZONTAL BORING MACHINES

12—Pratt & Whitney, No. 1, 2-spindle, Rifle Barrel Drilling Machines.
1—Niles, 2-apindle, car brass machine.
1—Flather.
1—Barnes, No. 3.
1—Niles, No. 1.
1—Newark.
1—Warner & Swasey.
4—Bement.
1—Binsse.
1—Beaman & Smith.
1—Binsse.
1—Bement Miles & Co.
1—Binsse.
1—Sellers, No. 3.
1—Bement.
1—Rochester, No. 2.
1—Beaman & Smith.
2—Beaman & Smith Cylinder—2-spindle.
1—Coffman, No. 2.

MILLING MACHIN S

1—No. 0 Cincinnati Plain Milling Machine
1—No. 25 Brainard Plain
1—No. 15 Garvin Plain
1—No. 1¼" Garvin Universal
3—No. 20 Oesterlein Plain
1—No. 20 Oesterlein Universal
1—No. 13½ Garvin Plain
2—No. 2 Cincinnati Plain
1—No. 2 LeBlond Universal
1—No. 2-A Owen Universal
1—No. 3 Becker Brainard Plain
1—No. 2-Y Brown & Sharpe Plain
1—No. 2-B Brown & Sharpe Plain
1—No. 2-H Brown & Sharpe Plain
1—No. 2 Kempsmith Plain
2—No. 3 Cincinnati Plain
4—No. 34 Oesterlein Plain
3—No. 9 Kempsmith Plain
1—No. 3 Kempsmith Plain
1—No. 3-A Owen Universal
1—No. 30 Ohio Universal
1—No. 5-B Becker Brainard Plain
1—No. 4 Becker Brainard Plain
2—No. 23 Brown & Sharpe Plain
1—No. 18 Kempsmith Plain
1—No. 5 Kempsmith Plain
1—No. 5-B Heavy Brown & Sharpe Plain
1—No. 5-B Becker Brainard Plain
1—No. 1 Berlin Universal
1—No. 29 Ohio Universal
2—No. 5 Berlin Plain
About 75 Hand Lincoln Millers

PLANERS

24" x 5' Flather
24" x 6' Whitcomb
24" x 6' Flather
2—24" x 6' American
24" x 6' Pond
4—24" x 6' Gray
24" x 8' Flather
26" x 6' Hendey
26" x 7' Gray
27" x 6' Ohio
27" x 7' Flather
30" x 6' Pease
30" x 8' Gray
30" x 8' Woodward & Powell
36" x 8' Ohio
36" x 10' Pond
42" x 36" x 13' Flather
48" x 13' Pond

HILL, CLARKE & CO., OF CHICAGO

125 N. CANAL STREET

If what you want is not advertised in this issue consult the Buyers' Directory at the back.

Personal

Charles Partridge, at one time one of the proprietors of the North Sidney Foundry, North Sidney, C.B., died on Sept. 14, aged 74.

William Delahaye, the Western manager of the National Mfg. Co., of Ottawa, died suddenly in Edmonton, recently. Mr. Delahaye was born in Pembroke, Ont., 54 years ago.

G. T. Hollaway, chairman of the Ontario Nickel Commission, has been making personal inspection of refining plants in Ontario. He was at Orillia and welland last week. The whole commission during the present week visit Sudbury, where they will investigate conditions.

W. F. Angus, vice-president and managing director of Canadian Steel Foundries, has been appointed a director of the parent company, Canadian Car & Foundry, Montreal, to fill the vacancy caused by the death of M. E. Duncan. He has also been added to the executive.

J. Norwood Duffus has taken over the interest of the late Mr. Francklyn in the well known firm of S. Cunard & Co., Halifax, N.S. The business is one of, if not the oldest established in Halifax, probably in the Maritime Provinces, and represents the Cunard, Compagnie Generale and other steamship lines. They also are general agents for Lloyds.

A. W. Draeseke, of the John Bertram & Sons Co., Dundas, Ont., has been made secretary of the Engineers' Committee for Standardizing Drafting Room Practice of the various plants of the Niles-Bement-Pond Co. Carl L. Grohmann, of the Pratt & Whitney Co., was elected chairman. The other members of the committee are G. E. Greenleaf, Pond Co.; A. E. Hogrebe, Crane Dept.; Edward Wray, Bement-Niles Works; Otto Pabst, Niles Works.

Tenders

Victoria, B.C.—The City Council have for sale a quantity of contractors' equipment. Full information may be obtained from the city purchasing agent at the City Hall.

Chatham, Ont.—The city engineer, F. P. Adams, is open to receive tenders for the machinery and equipment of the Chatham electric light plant, which consists principally of gas engines and producers, and electric generators.

Mimico, Ont.—Tenders will be received until Oct. 1 for the following works: sewers and water-mains, sewage disposal works, supply of sanitary vitrified pipes, sewage pumping station. Specifications and plans may be obtained from Engineer T. Lowe, 186 King street West, Toronto.

Ste. Martine, Que.—Tenders will be received by the Municipal Council of the Parish of Ste. Martine, County of Chateauguay, up to the 4th of October next for the construction of a steel bridge, 85 feet span, on concrete abutments, at the outlet of the Beau River, in this parish, according to plans and specifications to be seen at office of the undersigned. Nap. Mallette, secretary-treasurer.

Toronto, Ont.—Tenders will be received addressed to the chairman, Board of Control, up to Tuesday, October 12, 1915, for the construction and delivery of 36-inch stop valves, valve operating mechanism and special castings, for main pumping station. Specifications and forms of tender may be obtained at the Works Department, Room 12, City Hall.

Fort William, Ont.—Tenders addressed to the undersigned will be received until Thursday, September 30th, for heating, plumbing and electric wiring of the Registry Office, Fort William. Plans and specifications can be seen at the office of Geo. A. Eoll, Fort William, and at the Department of Public Works, Toronto. Also for the heating, plumbing and electric wiring of the jail building, Sault Ste. Marie, Ont., until October 7th. Plans and specifications can be seen on and after September 22nd in the sheriff's office, Sault Ste. Marie, and at the Department of Public Works, Toronto.

Ottawa, Ont.—Tenders will be received up to Tuesday, October the 19th, for the undermentioned items for delivery to H.M.C. Dockyards at Halifax, N.S., and Esquimalt, B.C.: Brass bars, antimony, iron firebar, brass sheets, aluminum, pig iron, brass tubes, steel angles, iron angles, copper sheet steel, boltstaves, iron boltstaves, copper tubes, steel plates, iron sheets, zinc plates, steel sheets, India rubber, lead, milled steel for tools, sheet packing, or sheet, etc. Forms of tender and all information may be obtained by application to the undersigned or to the Naval Store Officer at H.M.C. Dockyard, Halifax, N.S., or Esquimalt, B.C. Applicants for forms are requested to state definitely the item or items on which they desire to tender. G. J. Desbarats, Deputy Minister of the Naval Service.

Tenders for Scrap.—Sealed tenders for the purchase of a quantity of scrap metal at the Dominion Arsenal, Quebec, will be received up to noon of Thursday, the 23rd day of September, 1915. The quantities are approximately as follows:

	Lbs.
Brass, etc.	16,000
Charger steel	81,120
Steel, tool, lumps	13,950
Steel, mild, lumps	129,232
Turnings	72,074
Cast iron	183,848

The prices should be for delivery, ex stores, Dominion Arsenal, Quebec, material to be removed within 30 days after acceptance of tender. All the scrap is loose, and information required may be obtained from the Superintendent, Dominion Arsenal, Quebec; or Department of Militia and Defence, Ottawa.

Contracts Awarded

Cartierville, Que.—R. T. Smith & Co. have been awarded the contract for laying the intake pipe in connection with the filtration plant.

Ste. Ann's, C.B.—The Cape Breton Pulp Co. have awarded the contract to the local firm of Spurr & Israel for the rebuilding of their plant.

Winnipeg, Man.—The Ford Motor Co. have awarded the general contract for their new factory in Winnipeg to the Carter, Halls, Aldinger Co., of this city. The building will cost about $250,000.

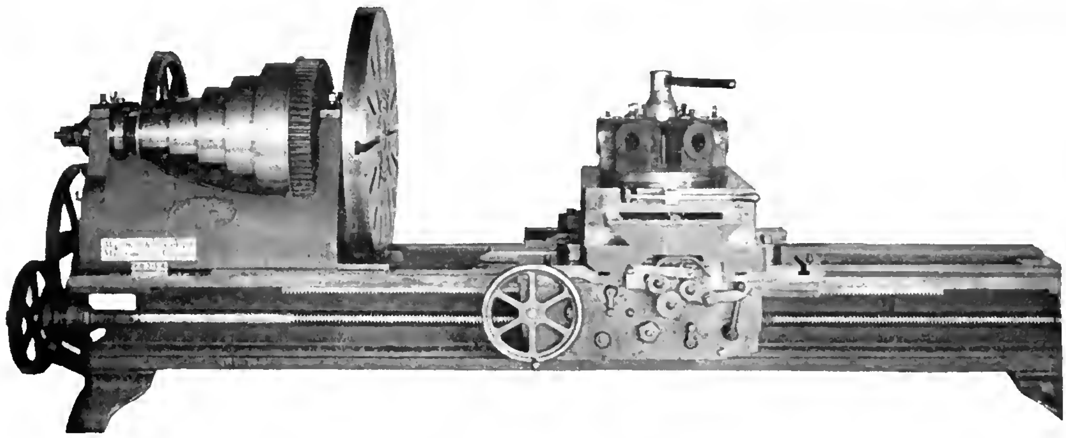
Regina, Sask.—The James Ballantyne Co., of Montreal, have been awarded the plumbing and heating contract for the new Simpson building, and the Vulcan Ironworks Co. will do the steel work.

The Thomas Davidson Mfg. Co., of Montreal, Que., have closed a contract for the installation of a "Snyder" electric furnace, built by the Snyder Electric Furnace Co., Chicago. The furnace will melt and refine cold steel scrap, producing high-grade steel for casting into blanks for the manufacture of shells. This is the second Snyder furnace to be constructed for to produce steel for use in making war munitions. The other furnace will be installed at Sherbrooke, Que., by the Canadian Brakeshoe Co. In view of the stringent requirements with regard to war munitions, it is significant of the development of electric furnaces that they are being installed for this purpose. The Thomas Davidson Mfg. Co. are well known as makers of stamped utensils, and as tin and sheet iron metal workers, and the cuttings from their stamping department will be used, together with scrap available in the district for melting down in the "Snyder" furnace.

Wood-Working

Moncton, N.B.—Mark's Carriage Factory has been destroyed by fire, with a loss of $25,000.

Listowel, Ont.—Work has been started on the new addition to the Malcolm furniture factory. The addition will be 62 by 46 feet, three storeys high, and will be built of brick.



42-inch New Haven Turret Lathe

BORING MACHINES

Barrett No. 1 Cylinder Borer.
34" Colburn Boring Mill.
42" Bullard Rapid Production Type, with one turret head, one swivel head, power rapid traverse, 3-jaw combination chuck table.

DRILLING MACHINES

28" Peerless Sliding Head, back gears, positive geared feed.
F-111 Baker Bros. Drill.
30" Fosdick Radial.
5' Western Full Universal Radial.

GEAR CUTTERS

15" Gleason Bevel Gear Planer.
16" Bilgrim Gear Planer.
22" Gould & Eberhardt Spur and Bevel Gear Cutter.
36" Fellows Gear Shaper.
36" x 10" Cincinnati Gear Cutter.

GRINDERS

Bath Internal Grinder.
No. 60 Heald Cylinder Grinder.
No. 7 Landis Gap Grinder.

LATHES

14" x 6' American, 5-step cone.
18" x 8' Lodge & Shipley, 5-step.
24" x 8' Harrington, 5-step cone.
24" x 10' American, 5-step cone.
36" x 16' Fifield.
42" x 20' Fifield, triple geared into face plate.

TURRET LATHES

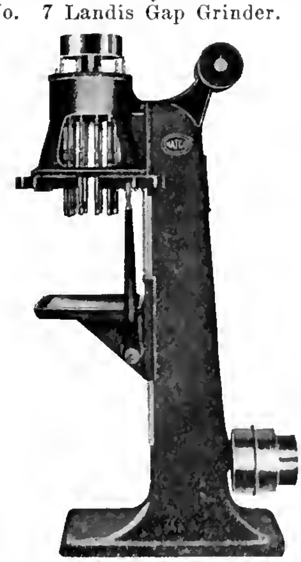
2" x 24" Jones & Lamson Flat Turret, cone head.
16" Warner & Swasey, plain head, pan bed.
16" Windsor Turret Lathes, pan bed.

MILLING MACHINES

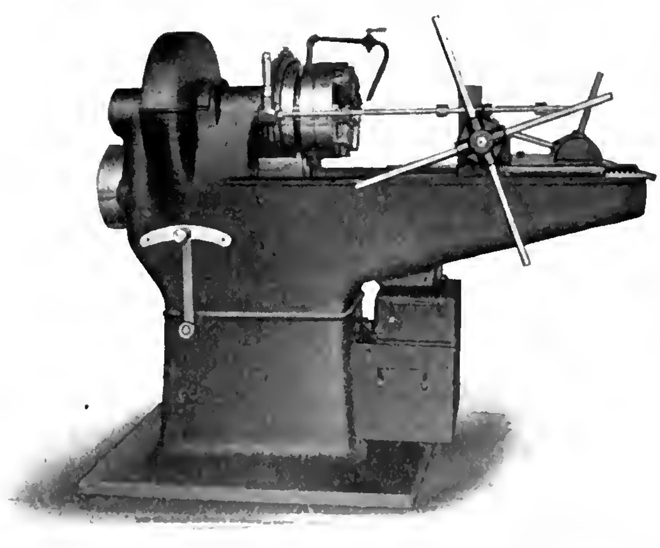
No. 3 Oesterlein, plain.
No. 3 Cincinnati, plain.
No. 3 LeBlond, plain.

PLANERS

22" x 22" x 5' Pond, one head.
28" x 28" x 6' New Haven.
36" x 36" x 10' American, one head.
48" x 48" x 12' Pond, one head.



Ten-Spindle Natco Drill.



1½" Single Pulley Drive Bolt Cutter with Landis All-Steel Die Head.

Send for full description, prices and our new list of New and Used Machine Tools

MARSHALL & HUSCHART MACHINERY COMPANY

17 South Jefferson Street, CHICAGO, ILL.

Uxbridge, Ont.—It is announced that a Toronto concern has taken over the old piano factory, and will make cabinets and office fixtures.

Trade Gossip

Latchford, Ont.—The new plant of the Canadian Pulp & Lumber Co., which was built on the site of the one destroyed by fire several months ago, was started last Saturday. It is the intention of the management to work night and day in order to catch up on the large stock of pulpwood now on hand.

Fort Francis, Ont.—After some two years of correspondence with the Hydro-Electric Commission at Toronto the Fort Francis Board of Trade, has succeeded in getting one of the engineers to make a special visit to inquire into the possible amount of power which could be disposed of in case Sand Island Falls should be developed.

Ball Bearing Contract.—In connection with the proposed manufacture of guns in Canada, it will be of interest to manufacturers to learn that the **Chapman Double Ball Bearing Co., Ltd.**, of Toronto, recently received an important contract for a very large number of sets of special ball bearings for a certain type of gun now being constructed.

John S. Metcalf Co., of Montreal, Chicago and London, have been awarded the contract by the Chicago and North-Western Railway Co. to act as designing and consulting engineers for that railway's new grain elevator plant at South Chicago. This plant will be operated by the Armour Grain Company, and is to be the largest and most complete grain handling and storing house yet designed by elevator engineers.

Toronto, Ont.—Over $2,000,000 has been spent on the harbor improvement work this and last year. About two hundred acres of land have been reclaimed in the Ashbridge Bay district. This is for factory sites, and is valued at $10,000 an acre. The cost of reclamation was $450,000, and the value of the land reclaimed is $2,000,000. Fifteen acres of park lands have been made for the city at Ward's Island.

The Thomas Davidson Mfg. Co., Montreal, Que., has closed a contract with the Snyder Electric Furnace Co., Chicago, for the installation of a Snyder electric furnace. This furnace will be used in melting and refining cold steel scrap, producing high-grade steel for casting into blanks for the manufacture of shells. The Thomas Davidson Company manufactures tin and sheet steel products and the cuttings from its stamping department will be used, together with scrap available in the district, for melting down in the furnace.

The Dominion Steel Foundry Co. directors announce the first dividend of 1¾ per cent. on the preferred stock. The concern is a merger of the Dominion Steel Castings Co., and the Hamilton Malleable Iron Co., with an authorized capital of $2,000,000, half common and half preferred. The stock is not listed. In 1914 the company reported a loss in operations of about $25,000, but this year war contracts have placed the finances in a secure position.

The Canada Cement Co. of Montreal, is understood to have secured large contracts for 75 mm. high explosive shells for the French and Russian Governments. The New York legal representative of the Canadian Co. has notified American firms that sub-contracts will be placed with them, and as a preliminary is asking for prices, time of delivery and capacity which each of the prospective bidders can guarantee. Each competing firm is also asked to send a representative to New York, to confer with Frank P. Jones, general manager of the Cement Company.

Steel and Radiation.—R. J. Cluffe has resigned the position of general manager followed by the resignation of H. S. Howard, the sales manager. As a result, the staff is now constituted as follows: general managing director, H. H. Macrae; assistant, T. R. S. K. Case; controller and secretary, F. J. Mayo; general sales manager, W. S. Cooke; assistant sales manager, H. O. Morris; chief heating engineer, James Wilson. Mr. Cluffe has taken over the management of his interests in Canada Pipe & Steel, and the Cluffe Manufacturing Co. Mr. Howard has been appointed to an important position with Lord & Burnham of St. Catharines, heating engineers.

Toronto Terminals Annual Meeting. — The annual meeting of the shareholders of the Toronto Terminals Railway Co. was held in the board room of the general offices of the C. P. R. in Montreal, on Sept. 14. Howard G. Kelly, president of the company, was in the chair, the other directors present being Sir Thomas Shaughnessy, Geo. Bury and I. G. Ogden. All the directors and officers were re-elected as follows:—Directors, Sir Thos. E. Shaughnessy, E. J. Chamberlin, Howard G. Kelly, George Bury, I. G. Ogden and J. E. Dalrymple. Officers, Howard G. Kelly, president; George Bury, vice-president; Henry Phillips, secretary; H. E. Suckling, treasurer; J. W. Leonard, general manager.

Demand for Brass Wire and Pins.—Manufacturers of brass pins in Birmingham and district, England, are experiencing much difficulty in producing brass wire, owing to the commandeering of supplies by the Government. The price of wire has doubled since last August, and Canadian manufacturers with surplus stocks should communicate with Birmingham buyers whose names and addresses may be obtained from the Department of Trade and Commerce, Ottawa. (Refer File No. 1362.) Manufacturers of steel and brass pins are offered more orders than their depleted staffs are able to execute. The subject may or may not be of interest to Canadian manufacturers; but conditions are so abnormal and irregular in the British commercial world that transactions quite impossible in ante-bellum days are now being conducted on a profitable basis.

Condition of Tool Market.—Workshops in the United Kingdom producing machine tools have been placed by the Government under the category of "controlled establishments" and are therefore under the control of the Munitions Department. These workshops will now be engaged in the manufacture of war requirements, and it will be interesting to watch the effect of the new conditions upon the output of tools generally, both for hand and machine use. Large quantities of mechanics' hand tools are imported in normal times, as well as certain classes of machine tools. If Canadian manufacturers will forward their catalogues to the Department of Trade and Commerce, Ottawa, every effort will be made to introduce them to importers.

New Incorporations

The Western Shells & Box Co. has been incorporated with a capital of $25,000 to carry on business at Edmonton, Alta.

The A. Schrader, Son, Inc., has been granted a provincial license at Toronto, Ont., with a capital of $40,000, to manufacture machinery apparatus and appliances of all kinds. Harold R. Cole, of Toronto, is attorney.

The Peninsular Pulp & Paper Co. has been incorporated with a capital stock of $200,000 by William E. Shafer, Edwin R. Larter, and others, of Niagara Falls, N.Y., to manufacture pulp, lumber and paper at Thorold, Ont.

The Pullman Motors, Ltd., has been incorporated at Ottawa with a capital of $100,000 to manufacture motor cars, trucks, etc., at Toronto. Incorporators, David Pullman, John E. Webb and George W. Webb, all of Toronto, Ont.

The Canadian Autopower, Ltd., has been incorporated at Toronto, with a

capital of $40,000, to manufacture power attachments for motor cars, etc., at Toronto. Incorporators—John Reid Robertson, Harold Wilson and Robert Angus, all of Toronto.

The Thompson-James Co. has been incorporated with a capital of $40,000, to manufacture explosives of every description, with head office at Toronto. Incorporators, Cecil H. Thompson, Arthur Stewart James and James R. L. Starr, all of Toronto, Ont.

The Alberta Flour Mills, Ltd., has been incorporated at Ottawa, with a capital of $5,000,000, to carry on a flour milling business, with head office at Calgary, Alta. Incorporators—Arthur T. Seyler, Thomas M. Ovens and Homer H. Farman, all of Calgary, Alta.

The Gowland Optical Co. has been incorporated at Ottawa, with a capital of $1,000,000, to manufacture optical and scientific instruments of all kinds at Montreal, Que. Incorporators—Joseph Armitage Ewing, George Samuel McFadden, and Richard B. Proctor, all of Montreal.

The Automatic Valve Company of Canada, Ltd., has been incorporated at Ottawa with a capital of $20,000 to manufacture automatic valves and other apparatus at Calgary, Alta. Incorporators—Francis W. Griffiths, Clare Montrose Wright, and L. Herson Miller, all of Calgary, Alta.

The Edmonton Power Co. has been incorporated at Ottawa, with a capital of $100,000, to carry on the business of a light, heat and power company. Head office at Montreal, Que. Incorporators—Aubrey Huntington Elder, Patrick Francis Brown, and Burton F. Bowles, all of Montreal.

Universal Measuring Devices, Ltd., has been incorporated at Ottawa, with a capital of $50,000, to acquire patents of and deal in or manufacture measuring devices and gauges, etc. Head office is in Toronto, and the incorporators are Cecil W. Stancliffe, Stanley A. Waggett, and Gerard Ruel, all of Toronto.

Catalogues

The Wentworth Institute, Boston, Mass., has issued a syllabus for 1915-1916, covering the one-year and two-year courses, also the evening shop and technical courses. A number of illustrations show interior views of laboratories and class rooms, etc.

The Mesta Machine Co., Pittsburgh, Pa., have issued bulletin "Ka," containing a horse-power chart for gears and pulleys. The chart may be used for determining the variables for rotating parts transmitting power, such as gears, pulleys, rope wheels, etc. Full particulars regarding this chart may be obtained by writing the company.

Furnaces.—The Monarch Engineering & Mfg. Co., Baltimore, Md., have issued a series of bulletins illustrating and describing some of their products, which include portable "Simplex" melting furnaces, tool room furnaces, core ovens, oil burners, etc. Full particulars are given of each type of equipment, and tables give the principal dimensions and capacities, etc., for each size. The bulletins are fully illustrated.

Fabroil Gears.—Bulletin No. 48703, issued by the Canadian General Electric Co., Toronto, illustrates and describes in detail the construction of "Fabroil" gears, which are applicable to numberless types of machine shop tools, such as lathes, planers, drill presses, etc. They are also well adapted for use on back-geared motors. The bulletin contains complete dimension tables for standard construction "Fabroil" gears for the

various diametral pitches which are accompanied by diagrams. Velocity and horse-power tables are included, also some interesting data on the selection of gears, with a number of tooth profiles. One page contains several useful formulae for gear calculations.

Use and Abuse of Ball and Roller Bearings is the title of a new twenty-page treatise by F. J. Jarosch, chief engineer of the Bearings Company of America. The text gives explanations and experiences which help in the selection, mounting and lubrication of ball and roller bearings in automobile gears and in all other rotating parts and is intended to help in detecting the real cause of trouble. Nineteen drawings are used to illustrate the text matter. Mr. Jarosch contributes in a very practical way, valuable thoughts to a much discussed subject, and automobile engineers as well as many others who are interested in the subject will be glad to know that a copy of this treatise may be obtained free upon request from the publishers, the Joseph Dixon Crucible Co., Jersey City, N.J.

Book Reviews

Bank Map of Ontario and Quebec.—A striking illustration of the financial progress throughout the two older provinces of the Dominion during recent years, with respect to banking facilities, is graphically shown in a new edition of a bank map of Ontario and Quebec which has been issued by the Department of the Interior at Ottawa. According to the information which has been incorporated in the publication, the number of branches in operation in 1901, the first year for which statistics of this nature are given, totalled approximately 500, in comparison with 2,000 at the present time. This interesting compilation of current banking information is valuable also as a railway map, showing as it does, the location, on the various main and branch lines, of all towns and cities. This, together with other general information, makes the publication very useful for reference purposes. A copy may be procured free of charge upon application to F. C. C. Lynch, Superintendent of the Railway Lands Branch, Department of the Interior, Ottawa.

Wind Stresses in Steel Frames of Office Buildings, by W. M. Wilson and G. A. Maney, has just been issued as Bulletin No. 80 of the Engineering Experimental Station of the University of Illinois. This bulletin is a mathematical analysis of the stresses in the steel frames of office buildings due to the

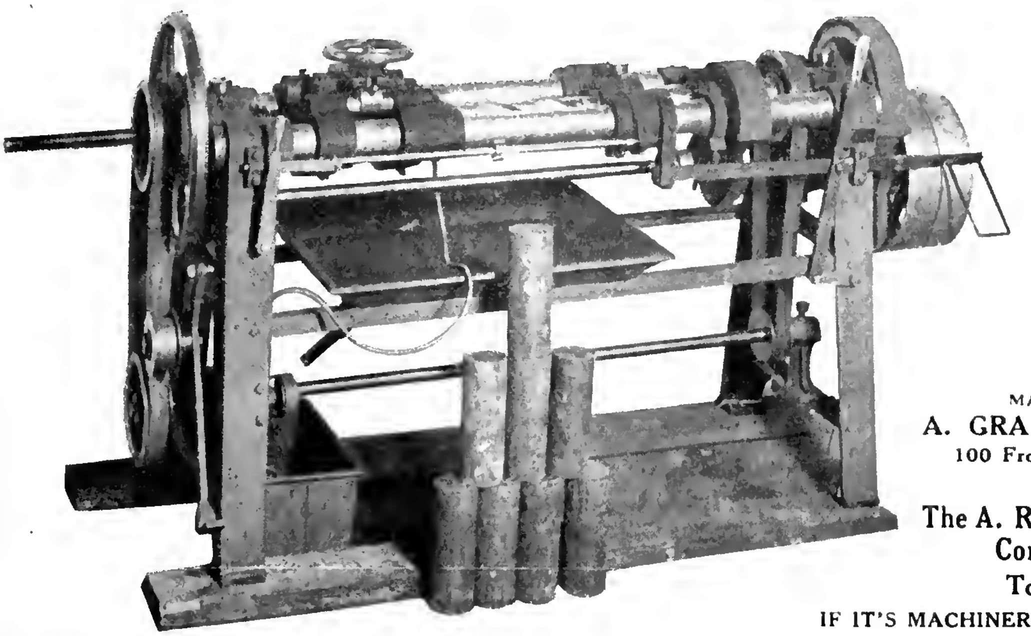
wind load on the building. It is the most extensive study of the subject which has appeared. The steel frames of office buildings resist the horizontal shear due to wind by virtue of the stiffness of the columns and girders. The sum of the moments at the tops and the bottoms of all of the columns in a story is equal to the total shear on the story multiplied by the story height. The distribution of this moment depends not only upon the relative stiffness of the columns but also upon the relative stiffness of the girders which connect the columns. Further, the distribution of the moment in one story depends not only upon the size of the members in that story but also upon the size of the members in the adjacent stories. General equations are derived which can be used to determine the wind stresses in both symmetrical and unsymmetrical bents from one to five spans wide and any number of stories high. These equations are used to determine the numerical values of the moments, shears and direct stresses in a symmetrical three-span bent twenty stories high. The method of determining these stresses presented in the bulletin is called the "Slope-Deflection" method. It is mathematically exact except for the assumptions upon which it is based. In the discussion of the assumptions the fact is brought out that while the assumptions are not exactly true, the errors do not materially affect the results. Four approximate methods are presented which are in use. The moments are determined in a number of bents having different proportions, by these approximate methods and by the slope-deflection method. This comparison shows that two of the approximate methods are so inaccurate that they should never be used. The other two approximate methods are quite accurate when applied to certain bents but when applied to other bents they may give results which are seriously in error. A new approximate method is presented which agrees with the slope-deflection method except where there are large changes in the size of the columns and girders. A model of a bent cut from a sheet of celluloid was subjected to a known shear. The deflection of the columns and the changes in the slope of the elastic curve at the ends of the girder as measured, and as computed by the slope-deflection method agreed very closely. The slope-deflection method can be used in the design of buildings but it has its greatest value as a standard for determining the accuracy of approximate methods. Copies of Bulletin No. 80 may be obtained from the European agent, Chapman and Hall, Ltd., 11 Henrietta St., Covent Garden, London, England.

THE A. R. WILLIAMS MACHINERY CO., LTD.

ST. JOHN, N.B. TORONTO WINNIPEG VANCOUVER

Canada's Leading Machinery House

THE BOYD SINGLE PURPOSE HORIZONTAL DRILL FOR DRILLING 18-POUNDER HIGH EXPLOSIVE BILLETS



Simple in operation, rigidly built, does not require an expert. Billet can be placed in position, drilled and removed in four minutes. There are no drill chips to remove after the operation is completed. Requires less than half the power of the ordinary Heavy Duty Drill.

Write for full information.

Prompt shipment.

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IF IT'S MACHINERY—WRITE "WILLIAMS"

DON'T WASTE TIME PUZZLING OVER YOUR TAPPING PROPOSITION

Submit it to us, and our Experts will tell you how it can be done TO YOUR BEST ADVANTAGE.

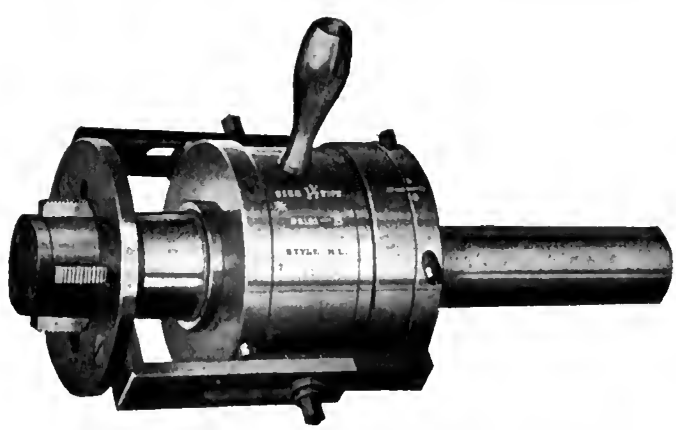
Geometric Collapsing Taps are arranged for all classes of thread tapping above ¾-inch diameter. Rigid while tapping, but collapse the chasers when the required depth is reached. Can be fitted to screw machine or turret lathe, also to live spindle, such as a drill press.

Let us send our booklet describing these Geometric Collapsing Taps in a general way, or, with your specifications at hand, we will describe your Tap in particular.

The Geometric Tool Company

New Haven, Conn., U. S. A.

Canadian Agents: Williams & Wilson, Ltd., Montreal. The A. R. Williams Machinery Co., Ltd., Toronto, Winnipeg and St. John, N.B.



Geometric Collapsing Tap, Class "N-L," Equipped with Chasers for Plug Tapping.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Mount Brydges, Ont.—The Crow Motor Co. plans a factory to manufacture automobile motors, to cost $10,000.

Medicine Hat, Alta.—The Medicine Hat Pump & Brass Mfg. Co. is in the market for three new lathes, 14 to 18 in., for immediate delivery.

Eustis, Que.—The Eustis Mining Co. will rebuild their mill, which was recently destroyed by fire. The cost is estimated at about $85,000.

Electrical

St. Hilaire, Que.—The Century Electric Co., of Montreal, will install an electrical transmission system for the town.

Weston, Ont.—Etobicoke township has agreed to all the conditions laid down by the Weston Hydro-Electric Commission for the lighting of Thistleton, and the work is to go on at once.

Chesley, Ont.—The ratepayers last Monday voted in favor of the Hydro bylaw, which passed by a large majority. The power will be turned on about Christmas, and it will come from Eugenia Falls.

Toronto, Ont.—Arrangements have been made between the Mimico Power Co. and the Etobicoke Township Council which will result in the extending of the system to Humber Bay. At a cost of about $1,500, a line will be run along George and Church Streets, following the request of the citizens who desire to become Hydro customers.

London, Ont.—Work on the new street lighting system which the utilities board will give to the city out of its surplus funds has already commenced, and it is expected that the 2,400 new lamps will be installed in the course of about six months. General Manager Buchanan states that the new lights will be 150 c.p. instead of 75, as at present.

Municipal

Verdun, Que.—The council have decided to make an extension to the 36-in. intake pipe.

Cranton, Ont.—The town council proposes to install a hydro-electric system at a cost of $5,000.

Owen Sound, Ont.—The town council contemplate making extensions to the waterworks system.

Petrolea, Ont.—The town council will take over the Petrolea Utilities Co. power plant at $15,000.

Crediton, Ont.—The council contemplates the installation of a power distribution and lighting system.

Perth, Ont.—The Canadian Electric and Water Power Co. are in the market for cast iron pipes and specials.

EQUIPMENT FOR AUSTRALIAN RAILWAYS.

Tender forms, specifications and drawings have been forwarded by Commissioner D. H. Ross, Melbourne, for equipment required by the Victorian and Queensland Government Railways. These tender forms will be open to the inspection of Canadian manufacturers when received at the Department of Trade and Commerce, Ottawa (refer File No. 1435). Particulars of the requirements, together with the date on which the tenders close at Melbourne are briefly outlined thus:—

Victorian Railways.

No. 29,410. November 24.—2 duplex boiler feed pumps as specified.

No. 29,421. November 24.—750 sq. yds. compressed felt as specified.

Queensland Railways.

Tenders close at the office of the Queensland Railways, Brisbane, on November 2, 1915, for 10—30,000 gallons conical wrought iron tanks.

The departure of mails from Vancouver are indicated thus:

From Vancouver, October 27, due at Melbourne on November 20.

Rosthern, Sask.—The town council will call for tenders shortly for the supply of a fire engine, hose, etc.

Ridgetown, Ont.—It is proposed to install an ornamental street lighting system here in connection with the new hydro system.

Port Dover, Ont.—The town council have decided to build a new pumping plant. James St. Pierre, Bear Line, Ont., is the commissioner.

Owen Sound, Ont.—The town council have authorized a $16,000 debenture issue to cover the cost of waterworks extensions. Cast iron pipe will be required.

Dorchester, Ont.—The construction of gas mains and connections in this town is being considered by the Southern Ontario Gas Co., St. Thomas, Ont. F. B. Tomb, London, is manager.

Markham, Ont.—Property owners, by a majority of 49, last Monday, voted in favor of the plan of waterworks extension drawn up by Engineer E. A. James. The cost of the work is about $20,000.

Lumsden, Ont.—The town council are negotiating with the local electric light company to purchase the plant in operation here. The question will be referred to the ratepayers before the deal is completed.

Hamilton, Ont.—Preliminary steps have been taken by the Board of Control to spend $35,000 on draining of all the low-lying territory in the north-east end of the city, below the Jockey Club ground.

Windsor, Ont.—If the recommendation made by the fire committee is approved by the city council, apparatus of a total value of $11,000 will be added to the equipment of the fire department. Tenders will shortly be asked for the contract of supplying Windsor with a new tractor and motor service truck.

Port Colborne, Ont.—A by-law to authorize an agreement with the Ontario Power Co. of Niagara Falls, Ont., to supply power to Port Colborne and Humberstone for a term of five years, was voted on recently and carried in Port Colborne, 124 for and 59 against, and at Humberstone 104 for and 7 against.

St. Catharines, Ont.—The ratepayers on September 21, by an almost unanimous vote carried a by-law granting a franchise for 20 years to the Relief Gas Co., which will supply natural gas wholesale to the municipal system. The city purchases the gas at 25 cents per thousand feet, and will distribute it to consumers at an estimated cost of 35 cents per thousand feet.

Sarnia, Ont.—A recommendation that the City Council negotiate for the purchase of the present electrical plant for $192,000, and submit a by-law to the

JOHNS-MANVILLE SERVICE COVERS THE CONTINENT

JOHNS-MANVILLE SERVICE TO THE MANUFACTURER

THIS Emblem is rapidly becoming one of the most widely known trade-marks on this continent; but even though it belted the earth, it could not stand more staunchly than it does to-day for the business principles underlying J-M Responsibility.

J-M Ferro Compound saves many a casting from the scrap pile and cuts down re-melting costs

J-M Ferro Compound makes many a casting, big or little, fit to send out that would otherwise be scrapped and melted for re-casting on account of blow-holes, sand holes, etc.

J-M Ferro Compound is a chemical iron cement that becomes, when dry, a part of the casting itself and so acts as a permanent repair.

It fills up sand holes and other defects permanently. It cannot dry up and fall out.

J-M Ferro Compound is mixed with water, applied with a trowel and hardens in a few hours. It can then be finished with a file or emery wheel, and as it is the same color as the casting, its presence can never be detected.

Its cost per casting is insignificant, but the sum of its savings is an important item in every foundry or machine shop business.

Ask our Nearest Branch for Descriptive Literature of Applications, Uses, etc., and let us Quote You Prices and Discounts.

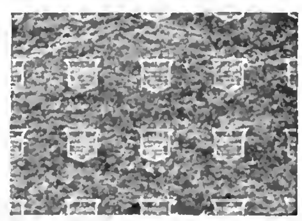
J-M Permanite—the Packing that has won its way on performance

J-M Permanite is a handy sheet because it is equally efficient on wet or dry joints. It has no respect for temperature or pressure, nor is it affected by ammonia, acids or alkali.

Then, too, it stays where it's put. It does not compress under any stress; in fact it expands under working conditions, making tight joints tighter.

J-M Permanite is very light in weight. When the J-M Salesman suggests J-M Permanite, say, "I'll try it once."

We are willing to let it convince you on the job.



J-M Permanite

The Canadian H. W. Johns-Manville Co., Ltd.

Manufacturers of Asbestos Roofings; Pipe Coverings; Packings; Mastic Flooring; Conduit; Stack Lining; Fireproof Paint; Fire Extinguishers; Fuses; etc.

TORONTO MONTREAL WINNIPEG VANCOUVER

199

ratepayers regarding the immediate installation of hydro was made at a special meeting of the council on September 22 by Messrs. J. J. Jeffery and L. F. Jeffery, engineers, of Toronto. The council decided to act on the advice and will take definite action at the next meeting.

General Industrial

Brantford, Ont.—The Concrete Post Co. has secured a site at Winnipeg, Man., and will erect a factory.

Georgetown, Ont.—The Glass Garden Builders propose establishing a factory here for building greenhouses, etc.

Wallaceburg, Ont.—An addition is being built to the Wallaceburg Cut Glass Works. A. Gregory, Dresden, Ont., is the contractor.

Renfrew, Ont.—Fire, on September 26, destroyed the flour mill at Pakenham owned and operated by the Renfrew Flour Mills Co. The mill, which was a stone structure and modern in every way, was totally destroyed. The elevator and office was also burned.

Woodstock, N.B.—Representatives of the Potato Products Co., of Belleville, Ont., have been looking over the ground in connection with the establishment of a business for the manufacture of starch, potato flour and dried potatoes. R. G. Graham, of Belleville, is the head of the business.

Wallaceburg, Ont.—The Dominion Sugar Co. is ready to start the erection of a million-dollar sugar factory in Chatham, and the only thing that is holding them up is the question of getting two railway spurs into their property, one from the Grand Trunk and the other from the C. P. R.

Tenders

The Pas, Man.—Tenders will be received up to October 5 for the supply and delivery of cast iron or steel water pipe and specials, also fire hydrants and valves. Particulars may be obtained from the resident engineer's office, or from Murphy & Underwood, engineers, Saskatoon, Sask.

St. Lambert, Que.—Tenders will be received up to October 4, 1915, for the installation of 42 lamp standards complete with about 6,500 feet of duplex underground cable terminals, etc. Plans may be seen, specifications and tender form had on application at the office of town engineer E. D. Drinkwater.

Orillia, Ont.—Tenders will be received until October 7 for miscellaneous iron work, heating, plumbing and electric wiring in connection with the rebuilding of the Municipal Buildings. Particulars may be obtained from the town clerk, Orillia, or from the architects, Burke, Horwood & White, Toronto.

Toronto, Ont.—Tenders will be received, addressed to the chairman, Board of Control, up to Tuesday, October 12, 1915, for the construction and delivery of 36-inch stop valves, valve operating mechanism and special castings, for main pumping station. Specifications and forms of tender may be obtained at the Works Department, Room 12, City Hall.

Ste. Martine, Que.—Tenders will be received by the Municipal Council of the Parish of Ste. Martine, County of Chateauguay, up to the 4th of October next for the construction of a steel bridge, 85 feet span, on concrete abutments, at the outlet of the Beau River, in this parish, according to plans and specifications to be seen at office of the undersigned. Nap. Mallette, secretary-treasurer.

Ottawa, Ont.—Tenders will be received until Tuesday, September 28, 1915, for one (1) motor generator set, one (1) induction motor, three (3) power transformers and switchboard apparatus to be delivered at the Government Printing Bureau, Ottawa, Ont. Specification and forms of contract can be seen and forms of tender obtained at the Department of Public Works and at the offices of Thos. Hastings, clerk of works, Postal Station "F," Toronto, Ont., and R. L. Deschamps, Superintendent of Public Buildings, Montreal, Que.

Toronto, Ont.—Tenders, addressed to the secretary-treasurer of the Board of Education, will be received until Friday, October 1st, 1915, for temperature regulators, sundry schools; cabinet work, including work benches, tables, cupboards, etc., for manual training and domestic science centres; concrete retaining wall, Roden School; local telephones, sundry schools; electrical work for science rooms, Harbord Street and Malvern Avenue Collegiate Institutes. Specifications may be seen and all information obtained at the office of the Superintendent of Buildings, City Hall, Toronto.

Ottawa, Ont.—Tenders will be received up to Tuesday, October the 19th, for the undermentioned items for delivery to H.M.C. Dockyards at Halifax, N.S., and Esquimalt, B.C.: Brass bars, antimony, iron firebar, brass sheets, aluminum, pig iron, brass tubes, steel angles, iron angles, copper sheet, steel boltstaves, iron boltstaves, copper tubes, steel plates, iron sheets, zinc plates, steel sheets, India rubber, lead, milled steel for tools, sheet packing, or sheet, etc. Forms of tender and all information may be obtained by application to the

undersigned, or to the Naval Store Officer at H.M.C. Dockyard, Halifax, N.S., or Esquimalt, B.C. Applicants for forms are requested to state definitely the item or items on which they desire to tender. G. J. Desbarats, Deputy Minister of the Naval Service.

Trade Gossip

The Canadian Malleable and Steel Range Mfg. Co. has increased the capital stock of the company to $350,000.

Phosphate of Lime.—Officials of the Conservation Commission report the discovery of extensive deposits of phosphate of lime in the National Park at Banff. The importance of the discovery to the agricultural industry of the West will be great, as phosphate of lime is of value in maintaining the fertility of the soil.

Big Orders from Italy.—A contract for 100,000 pairs of blankets and 600,000 woollen shirts has been placed with Canadian mills by the Italian Government Commission in London. The Dominion Department of Trade and Commerce has assumed responsibility for the inspection of the goods. Representatives of Canadian firms sent to London secured the orders, which approximate one million dollars.

Antimony Mine at Lake George.—There is a prospect of the early re-opening of the antimony mines at Lake George, York County, N.B. These mines have not been opened since 1909, owing to the low price of the ore. With an appreciable increase in ore prices, a proposal has been made by a syndicate to lease the mines for a term of years. The company have also under consideration an offer of sale.

Grain Moving East.—A despatch from Fort William, Ont., states that grain shipments from the West approximate 1,200 cars for the past few days, and none of the elevators have yet been forced to run full capacity. The railroads expect the receipts to increase until about October 10, when indications are that upwards of 2,500 cars will be received daily. Lake shipments, so far, have been small, but steamship men here are confident that the Canadian fleet will be capable, or nearly so, of handling the grain from Fort William as fast as the Eastern elevators can receive it. Many of the steamships which were chartered by the Canada Steamship Lines and other companies last spring for the Atlantic Coast trade are being returned to the lakes.

Regina C.M.A.—The manufacturers' committee of the Regina Board of Trade Council has been instructed to investigate and report on the advisability of organizing a Regina Manufacturers' Association and seek affiliation with the Canadian Manufacturers' Association.

The Tate-Jones Co., Inc., of Pittsburg, Pa., have received the contract for the large new heat treating plant to be erected at the Toronto factory of the Chapman Double Ball Bearing Co. The work, which has been rendered necessary by the greatly increased demand for ball bearings, includes large capacity oil-fired furnaces of the latest type, with complete equipment of oil storage, tank pumps, etc. **The Rudel Belnap Machinery Co.** of Toronto are Canadian representatives for Tate-Jones Co., Inc.

Oshawa Railway Co.—The annual meetings of the Thousand Islands Railway Co. and the Oshawa Railway Co. were held at Deseronto, Ont., on Monday, September 13, 1915, at which meetting the following directors were elected: E. Walter Rathbun, Deseronto; H. W. Cooper, Gananoque; J. H. ValLeau, Gananoque; B. R. Hepburn, Picton; D. A. Valleau, Oshawa.

Personal

W. J. Gage, of Toronto, has donated $10,000 to the Government for the purpose of buying an armored biplane.

Sir Lyman Melvin Jones, president of the Massey-Harris Co., Toronto, is in the West inspecting the company's Western agencies.

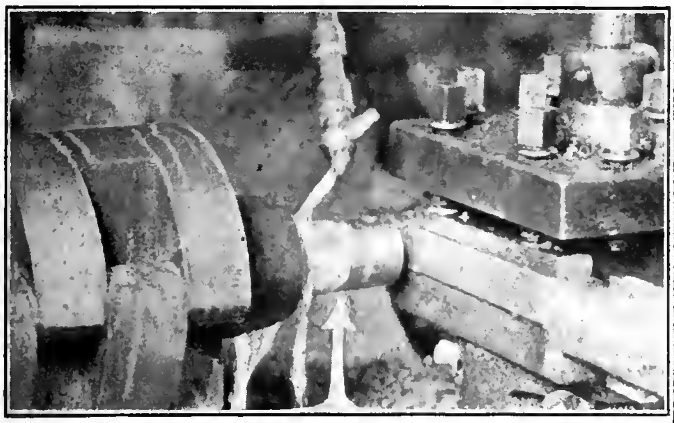
Sarnia, Ont.—From now until the close of navigation Capt. Foote will sail the steamer Hamonic, and Capt. Campbell will sail the Huronic, while Capt. Wright will remain ashore and perform the duties of shore captain.

Walter F. Wright, manager of motor sales, Canadian General Electric Co., Toronto, has resigned to accept a position as Ontario manager for the Eugene F. Phillips Electrical Works. Mr. Wright's headquarters will be in Toronto.

R. B. Larmour, assistant general freight agent of the C. P. R. at Vancouver, B.C., has been appointed to succeed the late W. F. Stevenson, of New York as general agent of the C. P. R. freight department, New York City.

Collingwood Schreiber, C.M.G. general consulting engineer of the Department of Railways and Canals, and L. K. Jones, Assistant Deputy Minister, are leaving on a semi-annual inspection trip through the West, and will go as far as Prince Rupert, the terminus of the G. T. P.

The A. R. Williams Machinery Co., Toronto, have a booth at the American Foundrymen's Convention and Exhibi-



ECONOMIC WATER OIL

SHELL MANUFACTURERS use ECONOMIC WATER OIL for METAL CUTTING of every description; it will not gum nor rust, and it SAVES TIME AND LABOR.

WE CAN SAVE YOU 50% in the **COST** of your **CUTTING MIXTURE** BECAUSE

ONE GALLON of ECONOMIC WATER OIL will mix readily with **30 to 50** gallons of WATER, making a thick, creamy emulsion, and giving you a cutting mixture which will not only be **satisfactory**, but will produce very **ECONOMIC RESULTS.**

One TRIAL ORDER will **prove** our STATEMENT.

Made in Canada

Canadian Economic Lubricant Co.
LIMITED
1040-1042 Durocher St. MONTREAL

DEPENDABILITY

should have first consideration.

LEVIATHAN and ANACONDA BELTING

are not low first cost beltings, but you are interested in the **ultimate** cost. We are responsible for every foot of LEVIATHAN and every foot of ANACONDA until it earns in actual service its full cost as compared with the service of any other belt of any kind, under the same or similar conditions, barring accidents. What it does beyond that wins and maintains your confidence.

Let us help you solve your belting problems.

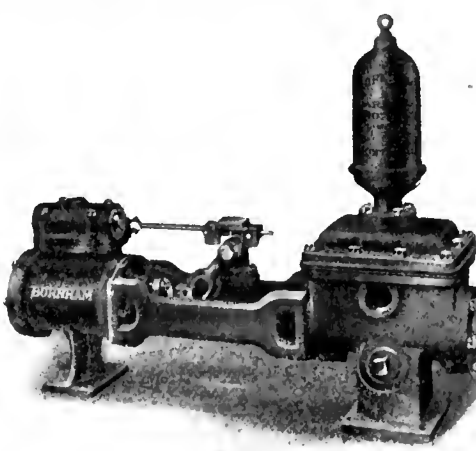
Main Belting Co. of Canada
Limited
10½ St. Peter St., Montreal

WATCH FOR OUR MESSAGE IN NEXT WEEK'S ISSUE

BURNHAM STEAM PUMP

Of the thousands of steam pumps installed every year, a large percentage of them bear the name of "Burnham," the *Steam Pump* endorsed by leading Architects, Consulting Engineers and Heating Contractors as the best, simplest and most economical pump on the market.

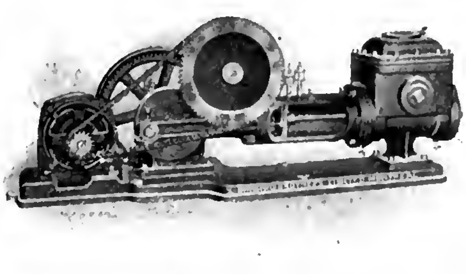
If you want a pump for handling hot water, use the "Burnham."



Burnham Boiler Feed Pump

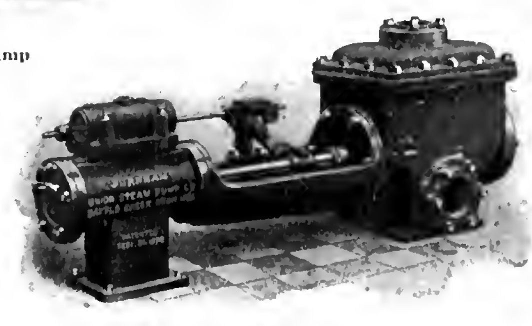
Thousands of Burnham pumps are in operation in connection with *Vacuum Heating Systems;* they are specially adapted for this service. Standard Burnham Boiler Feed Pumps and Burnham Vacuum Pumps are kept in stock and can be shipped promptly.

Ask for Catalog "P"



Union Electrically Driven Vacuum Pump

Darling Brothers
Limited
15 Ottawa Street
MONTREAL
Toronto — Winnipeg



Burnham Vacuum Pump

tion at Atlantic City, Pa. T. C. McDonald is in charge of the exhibit, which consists of literature and other matter dealing with shell making machinery. It was the intention of the company to have an exhibit of machine tools, but the idea had to be abandoned on account of the difficulty in obtaining the tools.

New Incorporations

Leek & Co., Ltd., Vancouver, B.C., has been incorporated with a capital stock of $100,000 to manufacture electrical goods, machinery, iron, steel, etc.

The Specialty Paper Bag Co. has been incorporated at Ottawa with a capital of $100,000 to manufacture jute, cotton, paper and all other kinds of bags at Ottawa. Incorporators: Irving Wells Smith, Gerald Morphy Malone, of Toronto.

The Lindsay Factories, Ltd., has been incorporated at Toronto with a capital of $50,000 to do a general manufacturing business with head office at Toronto. Provisional directors are G. E. Lindsay, S. W. Burns and Thomas W. Horn, all of Toronto.

The Electric Zinc Co., Ltd., has been incorporated at Ottawa with a capital of $24,000 to operate zinc smelters and refineries at Sherbrooke, Que. Incorporators: Leland Drew Adams and Charles Herbert May, of Oakland, Cal., and John P. Wells, of Sherbrooke, Que.

The A. T. Wattie Cold Storage Co., Ltd., has been incorporated at Toronto with a capital of $40,000 to carry on a cold storage business at Bracebridge, Ont. The provisional directors are John E. Wattie, Mervyn L. Watt and Ernest Green, all of Bracebridge, Ont.

The Orillia Molybdenum Co., Ltd., has been incorporated at Toronto with a capital of $200,000 to acquire and develop mineral lands and deposits. Head office at Orillia, Ont. Provisional directors are R. C. Dunbar, John E. Tudhope and J. Fraser Tudhope, all of Orillia, Ont.

The Russell Natural Gas & Oil Co., Ltd., has been incorporated at Ottawa with a capital of $1,000,000 to carry on the business of producing and refining petroleum products and natural gas, at Ottawa, Ont. Incorporators: Orlando Arthur Letts, John George Hackland, all of Ottawa, Ont.

The Harris Heating & Engineering Co., Ltd., has been incorporated at Ottawa with a capital of $25,000 to carry on the business of mechanical engineers, founders, smiths, etc., at Montreal, Que. Incorporators: Joseph Albert Harris, Avila Mayer and Louis A. Desy, all of Montreal, Que.

The Sorel Steel Foundries Co., Ltd., has been incorporated at Ottawa with a capital of $100,000 to acquire and take over as a going concern the business now carried on at Sorel, Que., by Beauchemin & Fils, Ltd. Incorporators: Louis Philippe Tremblay and Napoleon Latraverse of Sorel, Que.

The Canadian Cartridge Co., Ltd., has been incorporated at Toronto with a capital of $400,000 to manufacture copper, brass and steel products, also cartridges and shells, etc. Head office at Toronto. Provisional directors are William S. Morlock, Bruce McKinnon and Roy B. Whitehead, all of Toronto

Railways—Bridges

Owen Sound, Ont.—The Grand Trunk will rebuild a large section of the wharf fronting on their property during the coming winter. Local contractors are being asked for tenders on the work, which will probably run as high as $10,000.

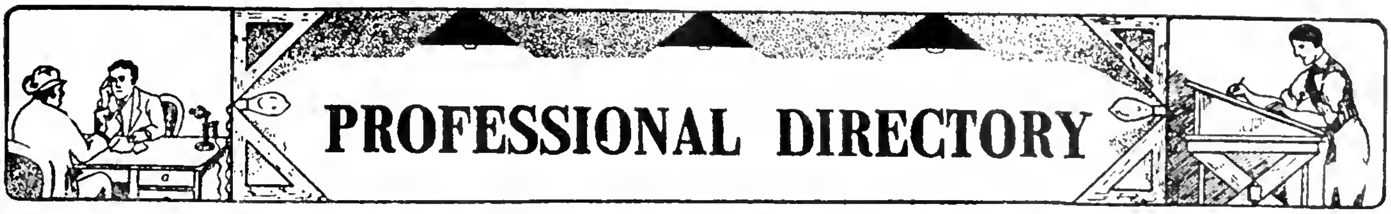
Weston, Ont.—Engineers of the Toronto Suburban Railway Co. have surveyed an extension of the radial line from Woodbridge to Kleinburg. Another branch line of the Weston division has been surveyed east of Weston and connects with the Davenport line at Davenport station.

Edmonton, Alta.—J. D. McArthur, president of the Dunvegan and Waterways Railways, states that steel laying will begin on the Waterways Railways by the end of September. The condition of the grading work is such that steel will be laid continuously until McMurray is reached, probably by the end of the year.

Cobourg, Ont.—Several municipalities in the counties of Northumberland and Durham are petitioning the Ontario Hydro-Electric Commission to make a report on the advisability of constructing electric railways from Peterboro and Campbellford to Cobourg, passing through the municipalities interested. Such roads would open a teritory now devoid of railway facilities, especially the northern part of Northumberland County.

Contracts Awarded

Toronto, Ont.—The National Regulator Co. has been awarded a contract for heat regulating apparatus for the Gledhill Avenue School.



PROFESSIONAL DIRECTORY

Building Notes

Hamilton, Ont.—The T. Eaton Co. has secured a permit to build a $110,000 factory here.

Saskatoon, Sask.—MacDonald-Crawford, Ltd., propose building a warehouse here to cost $50,000.

Ottawa, Ont.—The Bate Realty Co. will build an addition to their warehouse at a cost of $25,000.

Markham, Ont.—The Bank of Nova Scotia will at once begin the erection of a substantial brick structure on Main Street.

Toronto, Ont.—The Board of Education has obtained a building permit for a new school on Bartlett Avenue, to cost $52,900.

Clayton, Ont.—It is proposed to build a summer hotel here to cost $400,000. F. A. Wright, of New York, has prepared the plans.

Toronto, Ont.—The Toronto Pharmacal Co., has applied for a permit to erect a $7,000 addition to their factory on Brockton avenue.

Toronto, Ont.—A new school building will be erected at Fairbank, in York township. Edwards & Saunders, of Toronto, are the architects.

Toronto, Ont.—McGregor & McIntyre have obtained a building permit from the city architect's department for the erection of a two-storey brick factory, costing $8,700, at 1139 Shaw Street.

Toronto, Ont.—The C. P. R. has secured a permit from the city architect for the erection of the new North Toronto station, to be built of brick and stone, and to cost $125,000. It is to be a one-storey structure.

Catalogues

Split Pulleys.—The "National" All-Steel Split Pulleys are illustrated and described in a bulletin issued by Patten Co., of Chicago, Ill.

Electric Grinder. — The Hamilton-Beach portable electric grinder for grinding dies, reamers, cutters, etc., is the subject of a bulletin issued by the Canadian General Electric Co., Toronto. A description is given of the grinder, which is accompanied by illustrations showing the grinder in operation on different kinds of work.

A Chain of Evidence.—Publication No. 14 contains a number of illustrations of large power drives where Morse chains are used, accompanied by details of each. Other matter included deals with the Morse silent chain and the

CLASSIFIED ADVERTISEMENTS

¶ Those who wish to sell or buy a business, obtain competent help, connect with satisfactory positions, or secure aid in starting new enterprises should not fail to use the Want Ad. Page of "CANADIAN MACHINERY."

¶ If you want to sell or buy a second-hand lathe, planer or any other shop equipment, let "CANADIAN MACHINERY" pick out a seller or buyer for you. How about that second-hand engine or boiler which you would like to dispose of?

Rates (payable in advance):—2c per word first insertion, 1c per word subsequent insertion. 5c additional each insertion when Box Number is required. Each figure counts as one word.

WANTED

ONE DOUBLE END PUNCH AND SHEARS, 22" throat, about 7,000 lbs. This is new; punched one bridge, $500.00; also one 9" throat punch, ½". A. Dick & Sons, Alton, Ont.

WANTED—POSITION AS SUPERINTENDENT. Am open to consider the position of superintendent of any firm manufacturing war munitions. Have special knowledge of materials and have designed machinery and solved problems in connection with machining and forging shells. Have thorough understanding of operations. Am not looking for fancy salary. William Rodgers, A.M. Can. Soc. C.E., 1386 Delorimier Ave., Montreal.

FOR SALE

FOR SALE—COMPLETE 25 H. P. FAIRbanks-Morse stationary gasoline engine; nearly new. Allyn Bros., Bruce Mines, Ont. (10-21)

FOR SALE—DRILL PRESS, 20 IN. WHEEL and lever feed; condition fine. Price $50. Krug & Crosby, 369 Bay N., Hamilton, Ont.

FOR SALE—GOOD LOT METAL WORKING machinery for immediate delivery. All ready to run to help you with those urgent orders. Presses, drills, plain lathes, shears, threaders, tappers, headers, oil forges, automatic shavers and slotters, pulleys, shaftings, etc. Very low prices. Send for catalogue. Shelton Company, Shelton, Conn.

WANTED—First-class Engine and Turret Lathe hands, Boring Mill, Planer and Bench hands.

Canadian Westinghouse Company, Limited
HAMILTON, ONTARIO

FOR SALE

One new Holden-Morgan Thread Milling Machine for threading base 4.5 shells. Surplus, ordered in error.

Immediate delivery from stock. Price $650 F.O.B. St. John.

T. McAVITY & SONS, Ltd.
ST. JOHN, N.B., CANADA

"Rocker-Joint" construction. Copies of this publication may be obtained from the Morse Chain Co., Ithaca, N.Y.

"Burd Ring Wisdom" is the title of the new house organ which will be published at frequent intervals by the Burd Compression Ring Co., Rockford, Ill., the purpose being to place before those who have a desire to know the latest and most important findings in piston ring development. The first number has made a good start, and its friends will wish it success in the future.

The Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa., has recently issued Leaflets 3,805, 3,806, and 3,807 on the application of automatic control apparatus to cranes and steel mills. They show the scheme of main connections and describe the method of operation of the magnetic unit switches, as arranged for the severe service of steel mill practice.

"Aqualene" is the title of a bulletin issued by the Crescent Oil Co., New York. Aqualene is a cutting lubricant for automatics, turret lathes and other tools. The bulletin describes the qualities and principal features of this lubricant, and contains a number of illustrations showing the various classes of work for which it is being used. An interesting feature is the data on production and cutting speeds, etc.

Portable Tools.—The Stow Mfg. Co., Binghampton, N.Y., are mailing to the trade copies of bulletin No. 400, illustrating and describing a complete line of "Stow" portable tools. These tools are furnished with both belt and motor drive, a feature in some cases being a "Stow" flexible shaft combination. The various lines which are illustrated are accompanied by a brief description covering the principal features and demonstrate the utility of the Stow flexible shaft.

"Finding and Stopping Waste in Modern Boiler Rooms by the use of Cochrane Meters," is the title of a catalogue which has been issued by the Harrison Safety Boiler Works, Philadelphia, Pa. The catalogue deals with the "Cochrane" appliances for accurately measuring and recording boiler feed, condensate, blow off, heating returns, cooling water, etc. The appliances include metering heaters, independent meters, precision meters and metering hot wells. The subject of stopping boiler wastes is treated in a scientific and at the same time a practical manner. The catalogue explains how this can be successfully accomplished by means of the various apparatus, described. The halftones are exceptionally clear and in-

Pattern Manufacturers, Etc.

clude views of numerous installations in addition to several cross sections showing the general construction of the appliances and method of operation. This catalogue is well gotten up. It contains 62 pages of matter printed in clear type and is bound in attractive covers. Copies of this catalogue may be obtained on application to the Canadian Allis-Chalmers, Ltd., Toronto, Ont., who are the exclusive agents for Canada.

Turret Lathes.—Catalogue J-7, issued by the Gisholt Machine Co., Madison, Wis., illustrates and describes the standard "Gisholt" turret lathe. The introduction briefly describes the range of work covered by these machines. Following is a general description of the standard turret lathes, in the form of a specification in which the principal parts of the lathe are discussed. A half-tone engraving of the standard machine with weights and dimensions covering all sizes, are found on pages 8 and 9. Motor-driven lathes are described and illustrated on pages 10 and 11, while page 12 contains particulars and views of standard boring and turning tools, being a new design of standard tool equipment. Bar tools, facing heads and accessories are shown on pages 13 and 14, while the full-swing wing rest is described on page 15. Following are several pages devoted to cuts, showing various operations on "Gisholt" lathes, and a variety of parts which have been finished on these machines. A number of half-tones show "Gisholt" lathes installed in various shops.

The A. R. Williams Machinery Co., Toronto, Ont., have recently issued a new catalogue, No. 40, dealing with machinery and tools, mill and railroad supplies. The catalogue contains 782 pages, is bound in cloth covers and is fully indexed, having in addition an index to figure numbers. The large number of lines listed precludes mention of any particular product, but it is sufficient to say that a full line of machinery and supplies for various trades is illustrated and the essential particulars given for each. The compilation of this catalogue has entailed considerable work owing to the great amount of detail involved in the preparation of the price lists and arrangement of the illustrations. This is a most useful book of reference and should be in the hands of all managers, superintendents and purchasing agents. The cuts are very clear and the press-work generally of a high order. Copies of this catalogue will be sent to responsible persons on request.

Book Reviews

"**Buoys, Beacons, and Day Marks,** and other aids to navigation on the Pacific Coast of the Dominion of Canada," is the title of a publication issued by the Department of Marine and Fisheries, Ottawa. This is the fourth edition of a list of buoys, etc., which gives the exact location of each, also description and remarks arranged in tabulated form. A copy of this list will be sent free to any shipmaster on application to the chief engineer of the Department at Ottawa, or agent of the Department at Victoria, B. C.

United States Mining Statutes Annotated, by J. W. Thompson. 1915. 1,772 pp. In two parts. Cloth. Not sold separately, $2.50. The Bulletin No. 94 is intended for persons engaged in mining enterprises that come within the scope of the Federal mining laws, and as a guide in the determination of mining rights and duties. It shows the status of every Federal mining law, both laws relating to metal mining and those relating to coal, oil, and phosphate, and to mining on public, Indian, and railroad lands. It includes references to Alaska and the Philippine Islands, and is the only complete work in its field. Owing to the expense involved in the preparation and publication of this bulletin and the limited printing funds available for the use of the Bureau of Mines, it has been necessary to place a price of $2.50 on the work. Orders should not be sent to the Bureau of Mines, but should be addressed to the Superintendent of Documents, Government Printing Office, Washington, D.C.

HOW TO KEEP MEN IN YOUR EMPLOY—A POSSIBLE SOLUTION

(Continued from page 334)

have avoided all suggestion of paternalistic motives. The work has been from the men to the company, not from the company to the men. If anything new is to be introduced, we get hold of the leaders—those men whose intelligence is most developed. Having gained their favor, the less thoughtful will fall in line.

Importance of the Foreman

In our organization, we have paid particular attention to selecting the foremen. You cannot have an unintelligent head of a department, and expect the men to be up to standard. In hiring men, a well defined policy is adopted. This policy is known to the heads of departments and thoroughly understood in the employment office. It requires cer-

tain standards and no man is sent to a department who does not fulfill these requirements. The rest lies with the foreman.

Employes are encouraged to work out their own problems, and are largely instrumental in developing the conditions under which they work. As an example, a mutual aid association was organized 20 years ago, but for 15 years it was a failure. The officers were company officials and the men showed little interest. Each year there was a deficit which the company has to meet. The promise to pay half the dues, did not induce the men to join.

The association was reorganized and its success or failure put up to the men themselves. A new management was elected. At the end of the first year, the membership had increased more than 300 per cent., and $2,000 were in the treasury. The record has been maintained each year.

The Restaurant

The next feature was a restaurant. At the suggestion of the men, a small lunch counter was established about five years ago. It was well patronized and in a few months was moved to larger quarters. It has been moved to larger quarters on three different occasions. We now have a completely equipped restaurant serving 600 daily, and this will be doubled shortly.

Everything sells for three cents, except meat, which is four cents. Nevertheless, we have saved enough to pay for the equipment for which the company advanced $8,000. The food is excellent and for 15 to 20 cents a good-sized meal is secured.

Three years ago, we started to sell small quantities of sugar, coffee, flour, tobacco, etc., in the restaurant. Since that time, this department has become a large co-operative store, doing $10,000 to $12,000 business each month. All kinds of groceries, meats, boots, shoes, rough clothing, etc., are handled. Last year, through the store, 35 carloads of coal, 20 carloads of potatoes and five carloads of apples were sold at a large saving to employes.

Two years ago a bakery was started which now bakes 3,000 loaves per day. Everything used in the restaurant comes from this bakery. A lard rendering plant furnishes employes lard at 5 to 6 cents a pound less than other stores. An ice cream factory sells a large dish of ice cream, made from cream from our own dairy farm, for 3 cents per dish. Bread sells at 4 cents, for a loaf 2 ounces larger than the usual size. In the shoe department, $3.50 and $4.50 shoes sell for $2.50 and $3. Employes save from $3 to $12 per month per family on goods purchased.

Building and Loan Association

Three years ago, our employes organized a building and loan association. Since that time, business totaling over $200,000 has been done. The assets are over $100,000 and 73 employes have bought and built homes. A dividend of 5 per cent. has been paid each year. Money is loaned at 5½ per cent. There are more than 700 stock and savings accounts with employes.

These activities are fostered and encouraged by the company, but the management and organization is carried on entirely by committees of shop men. The company advanced the money, but almost all of it has been paid back by the employes.

No reason exists why any business concern cannot put the question of handling men and their welfare on a business basis and frankly state the business reason for such an undertaking. Our employes distinctly understand that anything the company fosters for their benefit is based upon the belief that it will bring returns in dollars to both. The employes have learned that capital and labor are interdependent—that both must prosper on the same basis. They are learning that demagogues and agitators do not fill pay envelopes and never will.

The Chevrolet Motor Co. of Canada, Ltd. has been incorporated at Ottawa, with a capital of $500,000, to manufacture automobiles, etc., at Toronto. Incorporators, Harry Horsman, George Edmund Wooldridge, both of Toronto, Ont.

Wood-Working

Montreal, Que.—A fire on September 28 did about $15,000 damage to the G. H. Randall Co. furniture factory.

Montreal, Que.—The sash and door factory of Benoit Sons, on St. Timothe Street, was destroyed by fire on Sept. 25.

Cache Bay, Ont.—Geo. Gordon & Co. are building a new mill, and will require woodworking machinery .

Cache Bay, Ont.—George Gordon & Co., Ltd., will rebuild its sawmill, recently destroyed by fire, at a cost of $75,000. Alexander Trottier is in charge.

Vancouver.—The sawmill and buildings of the British Canadian Lumber Co., at New Westminster, have been sold for $1,000,000 to Leonard Imboden.

Fredericton, N.B.—Donald Fraser & Sons, of this place, have purchased a property at Nelson, on the Miramichi, and will build a lumber mill at a cost of $80,000.

Bancroft, Ont.—There is a probability of a new industry being established here to make broom handles, spools, etc. G. A. Turner and Wm. Paul, of Toronto, are interested.

Refrigeration

Hamilton, Ont.—A scheme providing for the establishment of a cold storage system in connection with the central market meat ball is being seriously considered by some of the aldermen.

Marine

Bathurst, N.B.—It is announced that arrangements are being made for the completion of the harbor development work here.

Ottawa, Ont.—The Government steamer Montmagny, which was rammed and sunk by the collier Lingan in the St. Lawrence over a year ago, is to be raised. The steamer now lies in ten fathoms of water off Grosse Isle. The contract for raising her has been awarded to the Levis Wrecking Company at $27,000.

Canadian Coasting Laws.—The Lake Carriers' Association, of Cleveland, Ohio, has been officially notified that the Canadian coasting laws have been suspended and American ships will be permitted to trade between Canadian lake ports during the remainder of the season. During the navigation season of 1914 there were 105 vessels of Canadian registry employed in the grain carrying trade on the Great Lakes, their total tonnage being 350,000. Owing to the transfer of many of these ships to the ocean trade, there are available this season only 56 Canadian ships, with combined tonnage of 109,000.

Personal

W. F. Hume, late manager of the Dominion Architectural Ironworks, Montreal, has been appointed shop superintendent of the Quebec Engineering Co., Quebec.

A. B. Smith, manager of the G. T. R. telegraphs, has resigned on account of ill-health. H. Hulatt has been appointed his successor, with headquarters in Montreal.

Captain Henry I. Matthews, who died last week at Lakeport, Ont., was the founder of the Lakeport Canning Factory, which was one of the constituent plants of the Canadian Canners, Ltd. Until the latter organization was absorbed by the Dominion Canners, Captain Matthews was one of its directors.

Trade Gossip

The Kelsey Wheel Co., Windsor, Ont., have increased their capital stock to $250,000.

The Canadian Westinghouse Co., Hamilton, Ont., have been awarded a contract by the City of Ottawa, Ont., for switchboard and equipment, and also transformers, at a total cost of $23,165

The Monarch Engineering Co., has been licensed to carry on business in the Province of Ontario, with a capital not exceeding $40,000. Alex. Fraser, of Niagara Falls, Ont., is the attorney.

Large Munition Contract.—The officials of the Dominion Steel Corporation were in Ottawa last week working on an unusually large munition contract. No definite announcement has yet been made, but it is understood that arrangements are practically completed for the work to go ahead.

Spanish River Pulp & Paper Mills.—The annual meeting of shareholders was held on October 1, at which the report for the year ending June 30, 1915, was approved. The following were elected to the board of directors: W. E. Stavert, P. B. Wilson, T. Watson Sime, C. E. Read, B. J. Tooke, G. H. Mead and T. Gibson. The same board was elected by the Lake Superior Paper Co.

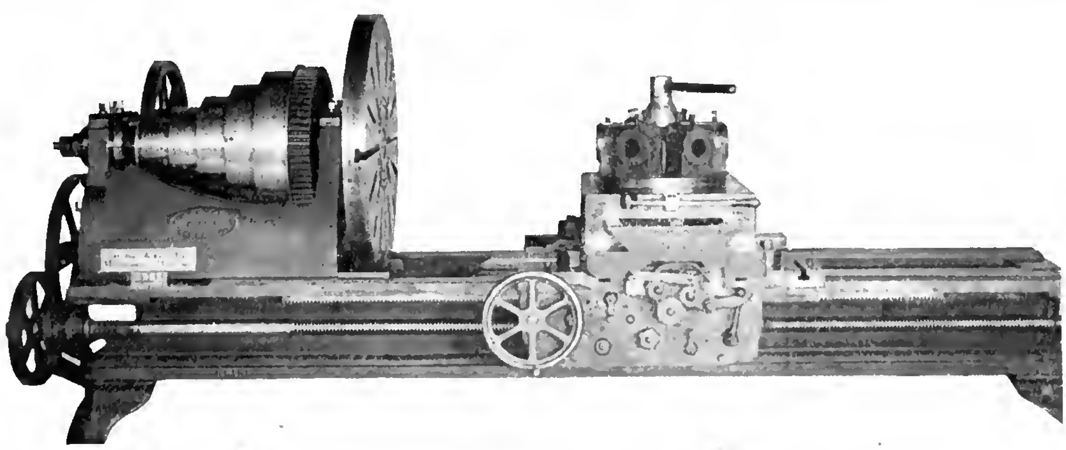
Canada Steamship Lines.—Five vessels of the Canada Steamships Lines fleet, now engaged in lake trade, are being reconstructed, and will be placed at the disposal of Canadian grain exporters for ocean service. This is the first step taken by the commission at Ottawa, of which Hon. Robert Rogers is president, to relieve the scarcity of tonnage, which is hampering Canadian export trade.

Dominion Steel Foundry Co.—An addition, 100 x 160 feet, to the main foundry building of the Dominion Steel Foundry Co., Hamilton, Ont., is nearing completion. The company has installed in this addition one 25-ton acid open-hearth furnace and one 30-ton Shaw electric 4-motor crane. The company has also installed a complete outfit for machining 3-inch British shrapnel shells and machinery for finishing 4.5 howitzer shells.

The Eastern Car Co., New Glasgow, N.S., subsidiary of Nova Scotia Steel & Coal, has shipped the first consignment of the two-thousand-car order placed by the Russian government. The shipment, consisting of 250 complete cars, was made in one of the vessels controlled by the parent company, and will travel to its destination via the Panama Canal. It is estimated that orders from the Russian and French governments will require fifteen steamers to transport. The company has increased its output during the past few weeks from 20 to 40 complete cars.

Ambulances Gift.—Noel Marshall accepted a motor ambulance on behalf of the Red Cross Society on September 30 from the employees of the McLaughlin Carriage Co., at the warerooms of the company in Toronto. Mrs. Ward, president of the Toronto District W.C.T.U., also presented a motor ambulance to the Red Cross Society through Mr. Marshall later in the afternoon at Willard Hall, Gerrard Street. Both these machines were the product of the McLaughlin Carriage Co., and will be sent to the front.

Inquiry for Grain Elevator Equipment.—A number of elevators for storage of grain are likely to be constructed in the near future by a foreign government these varying in capacity from 250,000 to 1,250,000 bushels. Such work has been supplied in the past from Germany but as further supplies are not obtainable from that country the government in question desires to be informed from Canadian sources the cost of elevators both in construction and in re-



If what you want is not advertised in this issue consult the Buyers' Directory at the back.

gard to machinery and equipment. Information can be obtained by reference to the Department of Trade and Commerce, Ottawa (File A-1575).

The Turbine Equipment Co., Toronto, have recently secured the following contracts:—Canadian Copper Co., Copper Cliff, Ont., two 7½ million-gallon a day De Laval centrifugal pumps, direct connected to Canadian Westinghouse motors; Pilkington Bros., Thorold, Ont., one De Laval 3-stage pump, direct connected to Canadian Crocker Wheeler motor; Samuel Austin & Co., Thorold, Ont., one De Laval single-stage pump, direct connected to Canadian Crocker Wheeler motor; Kerr Lake Mining Co., Cobalt, Ont., one De Laval 3-stage pump, direct connected to Canadian Westinghouse Co. motor.

Soo Canal Traffic—Eastbound traffic through the St. Mary's Falls Canals, Sault Ste. Marie, Ont., shows a large increase over September of last year, according to the monthly statistical report compiled by the engineer's office. Last year, 6,368,408 tons were locked through eastbound, while during September, 1915, 907,771 tons passed the Soo. The increase is shown in the entire list of commodities except flour, iron ore leading, of which 7,796,965 tons were carried through, or 2,509,808 tons more than September, 1914. Copper also shows a heavy increase, being 9,160 tons over last year. The amount of grain and wheat locked for lower lakes elevators was 31,927,870 bushels, against 27,579,621 for September, 1914, or an increase of 4,668,249. The passenger list eastbound during September this year was nil. Westbound traffic shows a decrease. The total freight, however, showed a net increase of 2,561,735 tons, 445 more passages being registered for the month over last year.

Catalogues

Trucks.—The "Lifton" truck for handling goods piled on platforms is described in a bulletin issued by the W. S. Mahaffy Co., Toronto. The truck is illustrated, and the essential particulars are given.

Reducing Valves, made by the James Morrison Brass Mfg. Co., Toronto. The J.M.T. standard reducing valve is fully described in this bulletin, which also includes directions for installing, cleaning and method of operation. The bulletin is illustrated.

"Foundry Filosofy" is the title of a booklet published by the Hill & Griffith Co., Cincinnati, Ohio, manufacturers of foundry facings, supplies and equipment. The booklet is a combination of

CLASSIFIED ADVERTISEMENTS

¶ Those who wish to sell or buy a business, obtain competent help, connect with satisfactory positions, or secure aid in st. rting new enterprises should not fail to use the Want Ad. Page of "CANADIAN MACHINERY."

¶ If you want to sell or buy a second-hand lathe, planer or any other shop equipment, let "CANADIAN MACHINERY" pick out a seller or buyer for you. How about that second-hand engine or boiler which you would like to dispose of?

Rates (payable in advance):—2c per word first insertion, 1c per word subsequent insertion. 5c additional each insertion when Box Number is required. Each figure counts as one word.

FOR SALE—GOOD LOT METAL WORKING machinery for immediate delivery. All ready to run to help you with those urgent orders. Presses, drills, plain lathes, shears, threaders, tappers, headers, oil forges, automatic shavers and slotters, pulleys, shaftings, etc. Very low prices. Send for catalogue. Shelton Company, Shelton. Conn.

FOR SALE—COMPLETE 25 H. P. FAIRbanks-Morse stationary gasoline engine; nearly new. Allyn Bros., Bruce Mines, Ont. (10-21)

FOR SALE—DRILL PRESS, 20 IN. WHEEL and lever feed; condition fine. Price $50. Krug & Crosby, 369 Bay N., Hamilton, Ont.

FOR SALE — FOUNDRY AND MACHINE shop, with lathes, shapers, drills, etc. Shop 90′ x 30′. Ten years old. Paris, Ont. Apply John Stewart, 203 William Street, Brantford, Ont.

WANTED

WANTED—POSITION AS SUPERINTENDent. Am open to consider the position of superintendent of any firm manufacturing war munitions. Have special knowledge of materials and have designed machinery and solved problems in connection with machining and forging shells. Have thorough understanding of operations. Am not looking for fancy salary. William Rodgers, A.M. Can. Soc. C.E., 1386 Delorimier Ave., Montreal.

Advertising

"Advertising is the education of the public as to who you are, where you are, and what you have to offer in the way of skill, talent or commodity. The only man who should not advertise is the man who has nothing to offer the world in the way of commodity or service."—*Elbert Hubbard.*

"Filosofy" for foundrymen and a brief description of the company's products. Polishing and plating supplies are included among the latter.

Steam Traps.—The Canadian Johns-Manville Co., Toronto, Ont., have issued a bulletin describing the "Johns-Manville" steam trap. The principal features of this trap are dealt with in detail, and the illustrations show the general construction. A table gives the capacity and dimensions of each size, and a list of users is also included.

Edison Mazda "C" Lamps, for standard lighting service, is the title of Bulletin No. 43603A, issued by the Canadian General Electric Co., Toronto. A full description is given of the Edison Mazda lamp and the wide field of application is dealt with. In the latter connection are a number of views showing a variety of installations in addition to illustrations of lamps, reflectors, and fixtures. Tables are included giving date on these lamps.

Steam Specialties and Mill Supplies.—Lytle, Smith & Co., Montreal, Que., have issued a new catalogue "A" dealing with an interesting line of flexible metallic hose, steam traps, packings, miscellaneous steam goods, tools, mill supplies, etc. The various products are illustrated and described, while complete price lists are included. This is a well gotten up catalogue, containing 62 pages, with index, and will be found useful for engineers and steam users to have on hand for reference.

TORONTO HYDRO-ELECTRIC REPORT

NET earnings of $303,686 for the first half of this year were recently reported by the Toronto Hydro-Electric system. The money was spent as follows: Interest, $130,948; interest on past instalments, $4,993; sinking fund instalments, accrued, $46,635; balance for depreciation and annual adjustments, $121,100.

The income of the concern for the first six months totalled $770,553, made up as follows: Commercial lighting, $295,708; commercial light, $174,662.51; municipal building light, $9,878; municipal power earnings, $80,287.84; municipal street lighting earnings, $170,916.20; rent of meters, $805.24; stores charges, $21,122.57; system consumption, $3,279.02; miscellaneous general expenses, contract account, $2,815.17; other municipalities, $1,700.39; non-operating income, $9,378.53. The cost of electric current was $184,835.63, and the expenses of operation, etc., $228,031.60.

The assets of the system are placed at $7,596,947.78, and the liabilities amount to $121,109 less.

General Manager Couzens declares that in spite of the war business has increased, that the unit cost of operation has decreased over 10 per cent., that the Hydro in the period mentioned benefited to the extent of $94,000, that the amount of power purchased from the Provincial Commission was $185,000, as compared with $147,000 in the same period last year, and that the system has not yet received from the city the proceeds of the debentures sold some months ago, and the amount due in respect of the loss on the bonds last year, amounting altogether to $1,350,000. The city, however, has a contra account for about a million dollars for interest and sinking fund.

AUSTRALIAN TRADE AND THE WAR

A COMPARISON of the manner in which Australian and Canadian trade have been affected by the war, and an official statement as to the number of soldiers Britain's Antipodean colony has contributed to the allied cause is contained in a report to the Canadian Government by Trade Commissioner Ross in Melbourne.

Australian trade during 1913-14 totalled $812,812,658, as compared with a Canadian total of $1,113,562,107. In 1914 her trade was but $608,652,014, as compared with Canada's showing of $1,078,173,240.

Since the declaration of war on August 4, 1914, the Commonwealth had organized, equipped and despatched 76,566 troops for active service abroad. At the present time 40,400 troops are in camps in Australia for despatch to the front. The Government has announced its determination to continue to train, equip and transport to the seat of war every available man presenting himself for service and who succeeds in passing the necessary medical examination.

To date, the grand total of the Australian expeditionary forces raised has reached 117,000 men, excluding 8,000 troops of the citizen forces mobilized for home defence. Reinforcements are going forward at the rate of 5,300 a month, and this number will be increased to 10,600 in October and in November. The various divisions comprise infantry, light horse, ammunition columns, artillery, engineers, army service corps, army medical corps, flying corps, veterinary sections, bridging train and pay corps.

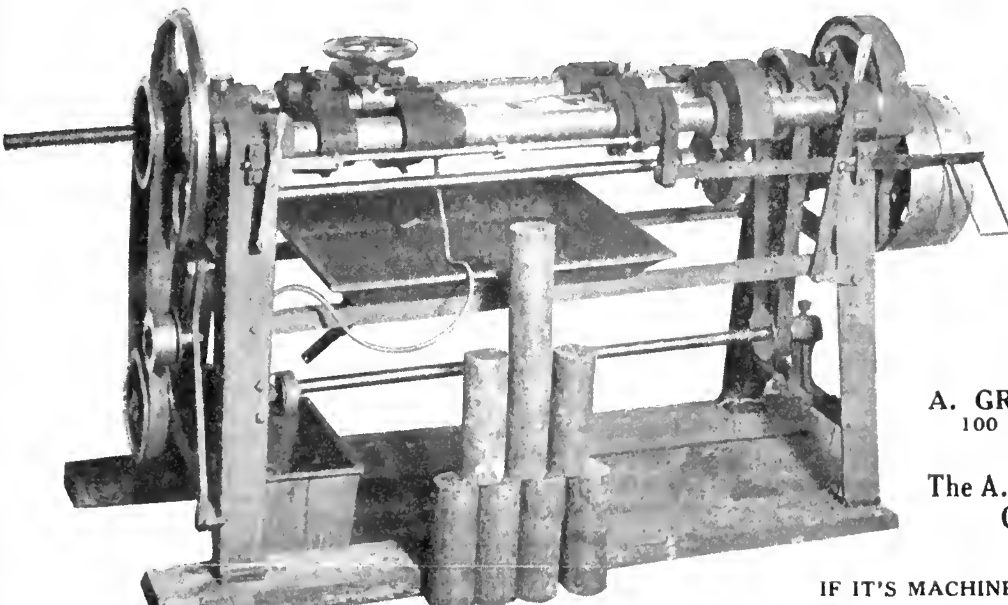
At the request of the Government of India a section of the Australian flying corps was despatched to the Persian Gulf, and is working in conjunction with the Royal Flying Corps. Further reinforcements are to be sent.

THE A. R. WILLIAMS MACHINERY CO., LTD.

ST. JOHN, N.B. TORONTO WINNIPEG VANCOUVER

Canada's Leading Machinery House

THE BOYD SINGLE PURPOSE HORIZONTAL DRILL FOR DRILLING 18-POUNDER HIGH EXPLOSIVE BILLETS



Simple in operation, rigidly built, does not require an expert. Billet can be placed in position, drilled and removed in four minutes. There are no drill chips to remove after the operation is completed. **Requires less than half the power of the ordinary Heavy Duty Drill.**

Write for full information.

Prompt shipment.

MANUFACTURED BY

A. GRAHAM BOYD & CO.

100 Front St. E., TORONTO

SALES AGENTS:

The A. R. Williams Machinery Company, Limited

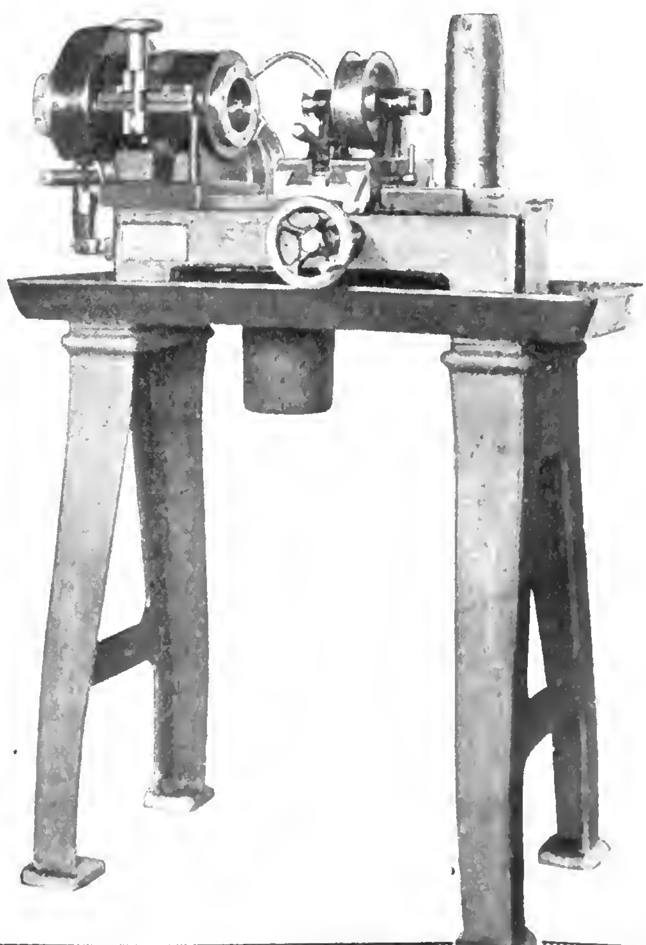
Toronto, Ontario

IF IT'S MACHINERY—WRITE "WILLIAMS"

Thread Milling Machines

For High Explosive Shells

Designed for the purpose of milling the thread in the base and nose of high explosive shells.



Shell is placed inside a revolving spindle and is self-centering. A perfect thread is produced in base of shell in approximately 2½ minutes.

Milling Cutter is made from best high-speed steel, by Brown & Sharpe, from special design by Holden-Morgan Co., and is so shaped that it can be sharpened without changing the form. Cutter is designed to mill the top of thread as well as the depth.

Machines are fully equipped for work, including oil pump. Fitted with automatic stop motion, which stops machine when thread is completed. One operator can run several machines. Eliminates all risk of having shells rejected on account of thread being stripped, as is liable to be the case when tapped by the old method.

Write for complete particulars, prices, etc.

THE HOLDEN-MORGAN CO., Limited

539 Richmond Street West, Toronto, Canada

SALES AGENTS:

The A. R. Williams Machinery Company, Limited

Toronto, Ontario

IF IT'S MACHINERY—WRITE "WILLIAMS."

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Quebec, Que.—Bronneau & Frere are receiving prices on steam pumps, steam boilers, etc.

Vancouver, B.C.—B. T. Rogers will build a machine shop to cost $25,000 on Granville street.

Guelph, Ont.—The Guelph Carriage Top Co. is in the market for a 50 h.p. to 80 h.p. engine.

Chatham, Ont.—The water commissioners have decided to buy a new boiler for the electric light plant.

St. Andre de Kamouraska, Que.—M. L. F. Germain will build a factory for the manufacture of scales, etc.

Petrolia, Ont.—Wm. Pratt has in hand the disposal of a machine and blacksmith shop fully equipped.

Toronto, Ont.—A compressed air tank exploded at the plant of the Canadian Ornamental Iron Co., River street, on October 5.

Chippawa, Ont.—The Norton Co. will make an addition to their plant at this place. The company manufacture abrasive wheels.

Cobalt, Ont.—New machinery is being installed in the McIntyre mill at Porcupine which will increase the capacity to 450 tons per day.

Vancouver, B.C.—R. V. Winch & Co. are in the market for one steam-driven air compressor of from 325 to 400 cu. ft. of air per minute with receiver, etc.

Rock Island, Que.—The Union Twist Drill Co. has let contract to Loomes & Dakin, Sherbrooke, for the erection of an addition to its plant at this place.

Bathurst, N.B.—It is announced that a brass and iron foundry will be established here. Messrs. Frank and Percy McCallum, formerly of Chatham, are at the head of it.

Galt, Ont.—Architect Evans has almost completed the plans for the new factory to be erected for the Galt Machine Screw Works. It is expected that construction will begin shortly.

Mount Brydges, Ont.—The Canadian Crow Motor Co. are building a factory here for making motor cars. The building will be 200 ft. by 50 ft. and will cost about $12,000. W. H. Longfield of this place is the contractor.

Smith's Falls, Ont.—The Rideau Power Co., contemplate completing the hydro electric power development here by installing two additional units. M. G. Henniger is the managing director.

Port Stanley, Ont.—It is understood that the Port Stanley Railway Commission will proceed at once with the erection of their railway shops and car barns. The contract has been let to Hayman & Sons at $27,000.

Bedford, Que.—Gray & Dunn, Montreal, have received the contract for the erection of a factory to cost $9,000 for the Bedford Mfg. Co., Bedford, Que. Saw and lathe equipment will be purchased by F. D. Welsh, manager.

Windsor, Ont.—The Water Commissioners are preparing specifications for a new 200-h.p. boiler they are contemplating installing in the waterworks plant in the near future. As soon as the specifications are completed tenders will be called for.

St. Thomas, Ont.—The incorporation at Ottawa recently of the Dominion Brake Shoe & Foundry Co. of St. Thomas with a capital stock of $200,000 is announced. It is believed the men interested are connected with the American Brake Shoe & Foundry Co. of the United States and Montreal, and that a large foundry will be erected shortly.

General Industrial

Prescott, Ont.—The Newell Mfg. Co. will probably establish a plant here.

Montreal, Que—The National Paper Co. will build a plant to cost over $100,000 for the manufacture of coated paper.

Hamilton, Ont.—The National Paper Goods Co. will build an addition to their factory.

Acton, Ont.—The Wallaceburg Knitting Co. plant may be moved here. The town will be asked for a loan of $10,000.

Mitchell, Ont.—The Walter Thompson & Son Co. have bought from the Canadian Cereal Co. the oatmeal mill in Seaforth, and are having it renovated.

Georgetown, Ont.—The by-law to grant assistance to the Glass Garden Builders has been passed. The company will erect a factory for making greenhouses.

Toronto, Ont.—A representative of the Kellogg Co., of Buffalo, N.Y., manufacturers of oil cake, and similar products, has been here securing information with regard to a proposed Canadian factory.

Toronto, Ont.—R. G. Long & Co., of 439 Wellington Street West, have purchased a site on King Street, west of Bathurst, for approximately $21,000. It is the intention of the purchasers to erect a five-storey building, at a cost of $80,000, for the manufacture of gloves, sweaters, and a general line of workmen's apparel.

Chatham, Ont.—The G.T.R. has agreed to install and maintain the interlocking switch necessary to put a spur into the proposed site of the sugar factory which will be erected here. This has been holding up the proposition of the Dominion Sugar Co. who are considering the erection of a million-dollar plant in this city. The city council will now prepare the by-law granting a free site to the sugar company, and a by-law will be submitted to the electors.

Municipal

Petrolia, Ont.—The town council at a special meeting by a vote of five to four, decided to take over the electric light plant at $11,280.

Dryden, Ont.—The installation of a telephone system is contemplated. A by-law will be voted on to authorize the expenditure of $5,000.

Newmarket, Ont.—A by-law is contemplated to guarantee the bonds to the extent of $15,000 of a boot and shoe concern as an inducement to locate here.

Renfrew, Ont.—The town council are negotiating with a company who propose establishing a plant here or in this district. M. J. O'Brien is interested in the enterprise.

Petrolia, Ont.—A by-law will be submitted to the ratepayers in connection with the proposed beet sugar refinery. E. Hyatt and R. G. McKenzie are interested in the proposition.

Sherbrooke, Que.—Tenders are all in for the proposed gas plant. The city council will probably engage an expert to examine and report on the tenders before awarding the contract. Three bids were received, ranging from $30,980 to $40,042.

When times are good, time is cheap.
When times are hard, time is dear.

When your factory was running overtime, and you had to stop your advertising because you couldn't fill your orders, you didn't feel so badly if an occasional employee wasted an occasional hour.

It was bad business then, or any time, but, well "times were good."

Now, in these days when efficiency and economy are the watchwords that must lead us in to the promised land of peace and plenty again—what about the time of your employees that you are paying for, every minute of it? Are you getting it—every minute of it? Have you a time-recording system that will do these things:

1. Show every employee in figures of his own making how much of your time he has wasted.
2. Save the big waste in "walking time" from the place of "punching in on the clock" to the bench or desk.
3. Enforce publicity, and a lot of it, at every registration.
4. Leave the employee satisfied with the registration, because it is plainly visible and is known to be unalterable.
5. Give you a practically ready-made pay-roll at the end of the week.

If you haven't, then the golden minutes are draining away unseen, every day and four times a day, and with them your profits, maybe the small margin that makes all the difference between dividends and no dividends, Mr. Manufacturer.

If you would like to become posted on the workings of a System that is designed to stop the Time-leaks in YOUR factory, write us to-day.

The International Time Recording Company of Canada, Limited
TORONTO, CANADA

F. E. MUTTON,
General Manager

Phone Main 2469

Offices—RYRIE BLDG.
Cor. Shuter and Yonge Sts.

Toronto, Ont.—Mimico and New Toronto may get a sewerage system, a disposal plant, and a water pumping system sufficient for the needs of the two municipalities for $125,000. Nineteen tenders were opened on Oct. 5, at a joint meeting of the two councils, and while no tender was accepted, the price of the work will be approximately as stated.

Electrical

Winnipeg, Man.—The city will purchase a number of ornamental arc lamps.

Hensall, Ont.—The town council are considering the installation of a hydro-electric power and lighting system.

Galt, Ont.—The installation of an ornamental lighting system is contemplated by the town council at an estimated cost of $6,860.

Brantford, Ont.—At a meeting of Brantford Township Council held recently, a by-law was passed authorizing the township to enter into an agreement with the Hydro-Electric Power Commission, and the reeve of the township was given power to sign the contract.

Contracts Awarded

The Canada Iron Corporation have been awarded the contract for 2,400 lineal feet of cast iron water pipe by the City of Winnipeg.

Hull, Que.—The City Council have let the contract for the installation of a street lighting system to Marchant & Donnelly, Ottawa, at $4,900.

Ottawa, Ont.—The City Council have awarded the contract for a switchboard and apparatus to the Canadian Westinghouse Co., Hamilton, Ont., for $11,-912.

Hull, Que.—A contract has been awarded by the City Council to E. Laurie Co., Montreal, for two 8-million-gallon De Laval centrifugal pumps, with Canadian Westinghouse motors.

Ottawa, Ont.—The City Council have let the following contracts:—Supply of lock bar pipe, Laurin & Leitch, Montreal, $194,400; pumps, Escher-Wyss Co., Montreal, $10,900; motors, Canadian Westinghouse Co., $14,600; special castings, Victoria Foundry Co., $2,455; valves, General Supply Co., $14,518.

Lambeth, Ont.—The Town Council have awarded the contract for hydrants and valve boxes to the London Foundry Co., and for cast iron pipe to the Gartshore-Thompson Foundry Co., of Hamilton. The Des Moines Bridge and Iron Co. will supply a water tank. The above work is in connection with a new waterworks system.

Railways—Bridges

Ottawa, Ont.—The Ottawa and New York Railway Co. has given notice of an application to the Railway Commission for approval of a lease from the Ottawa and New York to the New York Central Railway Co.

Toronto, Ont.—Plans for hydro radial trunk lines from Sarnia to Toronto, touching London, St. Mary's Stratford, Guelph and points east, will be submitted to a representative meeting of the Hydro radial to be held in Guelph during the present week.

Tenders

Toronto, Ont.—Tenders addressed to the secretary-treasurer of the Board of Education will be received until Friday, October 15, 1915, for new school building on Sydenham street. Specifications may be seen and all information obtained at the office of the Superintendent of Buildings, City Hall, Toronto.

Ottawa, Ont.—Tenders will be received up to Tuesday, October the 19, for the undermentioned items for delivery to H.M.C. Dockyards at Halifax, N.S., and Esquimalt, B.C.: Brass bars, antimony, iron firebar, brass sheets, aluminum, pig iron, brass tubes, steel angles, iron angles, copper sheet, steel boltstaves, iron boltstaves, copper tubes, steel plates, iron sheets, zinc plates, steel sheets, India rubber, lead, milled steel for tools, sheet packing, or sheet, etc. Forms of tender and all information may be obtained by application to the undersigned, or to the Naval Store Officer at H.M.C. Dockyard, Halifax, N.S., or Esquimalt, B.C. Applicants for forms are requested to state definitely the item or items on which they desire to tender. G. J. Desbarats, Deputy Minister of the Naval Service.

Building Notes

Toronto, Ont.—An addition will be built to the plant of the Swift Canadian Co., West Toronto.

Toronto, Ont.—A permit has been issued for the erection of a three-story brick school on Bartlett Avenue, near Hallam Street, to cost $52,900.

Fredericton, N.B.—R. Chestnut & Sons have applied to the city council for authority to erect a building to be used as a magazine for the storage of explosives.

Hamilton, Ont.—It is estimated that the new bridge at Valley Inn Hill will cost $500,000 to construct. Rock for foundations has been found at 91 feet, and the advisability of proceeding with the work is being considered.

Brighton, Ont.—The local Board of Education has awarded the contract for a new school to the Sutherland Construction Co., of Toronto. The tender amounted to $45,980. Telephone and heat regulating systems to cost $1,063 may be installed at a later date.

Toronto, Ont.—Plans for the new Union Station were submitted to the city architect on Oct. 6, by the Toronto Terminal Co., with a request for a permit to go on with the work. The expenditure provided for $3,340,000, although the original estimate was only $3,000,000. The Dominion Railway Board has approved of the plans, which provide for a station larger than that called for by present conditions.

New Incorporations

The Roelofson Machine & Tool Co. has been incorporated at Ottawa with a capital of $50,000 to carry on a machinery business at Toronto, Ont. Incorporators: Harry Riley, James White Bicknell and Alfred Bicknell, all of Toronto.

The Canadian McCall Incinerator Co. has been incorporated at Ottawa with a capital of $300,000 to take over patents for incinerators and carry on a manufacturing business at Toronto, Ont. Incorporators: Frank Denton, John Irwin Grover and James McEwen, all of Toronto.

Universal Appliance Mfg. Co. has been incorporated at Ottawa with a capital of $150,000 to manufacture automobiles, cycles, trucks, etc., at Toronto. Incorporators: John F. McGregor, Thomas S. Giles and John S. Duggan, all of Toronto, Ont.

The Canadian Tygard Engine, Ltd., has been incorporated at Ottawa with a capital of $3,000,000 to manufacture the "Tygard" rotary steam engine and gas engines. Head office at Toronto. Incorporators: Charles H. C. Leggott and William W. Perry, both of Toronto, Ont.

Refrigeration

Ottawa, Ont.—The Ottawa Dairy Co. have let the general contract for the erection of an ice-making plant to the Wegnier Machine Co., Buffalo, N.Y. The cost of plant and building is estimated at $15,000.

Wood-Working

Trenton, Ont.—J. Whiteley is in the market for woodworking machinery, etc.

Montreal, Que.—Fire did about $4,000 damage to the M. Charion Co. saw mill on Burnet street, on Sept. 30.

Preston, Ont.—The Preston Car & Coach Co., is preparing to instal machinery for the manufacture of shell boxes on a large scale as the Government has placed a big order with them.

Cache Bay, Ont.—George Gordon & Co. are in the market for two double cutting band mills, one horizontal resaw, together with edgers, lath mills, trimmers, etc., to be installed in a mill to be built at Cache Bay at a cost of $75,000.

Personal

E. S. Edmondson has tendered his resignation as managing director of the Interurban Electric Co.

Charles Stewart, one of the senior partners of Burrow, Stewart & Milne, founders, died at his home in Hamilton, Ont., on Oct. 8, at the age of 78.

J. D. Shields, chief inspector of electrical appliances for the City of Toronto, has resigned, the office having been abolished by the Provincial Hydro Commission.

William Walters, inspector of the new harbor improvements at Toronto, Ont., died at Lindsay, Ont., on Oct. 5. The deceased was born at Kingston, Ont., on Aug. 11, 1854.

Lieut.Col. Frederic Nicholls has been appointed acting president of the Dominion Steel Corporation on account of the continued indisposition of the president, T. H. Plummer.

Capt. Charles H. Jenkin, for many years in command of Grand Trunk car ferry boats, and well known in Great Lakes marine circles, died at his home in Detroit last week after a long illness.

William H. Boughner, assistant engineer of St. Thomas, Ont., has been appointed civil engineer at Port Arthur, Ont., with a salary of $2,500 per year. Engineer Boughner is a native of St. Thomas, and a graduate of Queen's University.

Major T. A. Russell, vice-president and general manager of the Toronto, Ont., Russell Motor Car Co., while in Detroit recently placed orders for motors and parts for armored motor trucks, for which he received an order while at the military camp at Salisbury Plain, England.

C. H. Fullerton, mining engineer of New Liskeard, Ont., has been appointed superintendent of Colonization Roads for the Province of Ontario, taking the post made vacant by the death in France at the battle of St. Julien of Major G. W. Bennett.

C. E. Henderson, assistant city engineer of Port Arthur, Ont., has been appointed city engineer of St. Augustine, Florida. Mr. Henderson graduated in civil engineering at the University of Illinois in 1906. He has been assistant city engineer of Port Arthur since June, 1910.

Corporal J. J. Campbell, formerly Montreal representative of the Swedish General Electric Co., and latterly of the 13th Battalion, Royal Highlanders of Canada, is reported as being a prisoner of war at Wetzlar, near Giessen. Later when announcement was made of decorations by the Czar of Russia, Mr. Campbell received the Cross of St. George, first class.

Trade Gossip

The Canadian Furnace Co. report good business. They are shipping about 700 tons of pig iron every day.

The Preston Car & Coach Co., Preston, Ont., has received an order for a number of steel frame electric cars from the Lake Erie & Northern Railway.

The Canadian Tygard Engine Co. has opened an office at 202 Royal Bank Building, Toronto, Ont., to demonstrate the "Tygard" rotary steam engine.

Regina, Sask.—The Publicity Commissioner has issued a brochure containing views of the principal public buildings, residences, street scenes, etc., in the City of Regina.

The Canadian Hoskins, of Walkerville, Ont., makers of electric, gas and oil furnaces, and pyrometers have opened up a sales office at 112 St. James St., Montreal, Que. The office is in charge of T. E. Freeman, B.A. Sc.

Orangeville, Ont.—The Ontario Hydro Electric Power Commission has taken over the Pine River Light & Power Co. dam and power plant at Horning's Mills. The Town of Orangeville will take over and operate the company's distribution system.

Canada Machinery Co.—The Canada Machinery Corporation of Galt, Ont., is understood to be operating at full capacity. The plants have been busy for some time past on the manufacture of machinery for industrial concerns that are engaged in the production of war munitions.

If what you want is not advertised in this issue consult the Buyers' Directory at the back.

Advertising

"Advertising is the education of the public as to who you are, where you are, and what you have to offer in the way of skill, talent or commodity. The only man who should not advertise is the man who has nothing to offer the world in the way of commodity or service."—*Elbert Hubbard.*

B. C. Wants War Orders.—With the object of improving British Columbia's position in the distribution of war contracts, a deputation from that Province visited Ottawa and interviewed the Prime Minister, Hon. Martin Burrell and Hon. A. E. Kemp on October 8. The deputation included Blair, Cunningham and Bushby, of Vancouver, and Wesley Newcombe, of Victoria.

Victoria, B.C.—The Canada Potash and Algin Co., has its arrangements nearly completed for beginning work. This company was promoted by Macdonald Fahey, who is its managing director, the other directors being Charles R. Dinsford, Captain D. McIntosh, Arthur H. Pigott and T. B. Mohler. The company controls in Canada the Mohler processes for the treatment of kelp made from seaweed. A plant has been leased at Sidney in which machinery is being installed for making kelp, potash and gum algin.

Toronto, Ont.—Sir Adam Beck, Hon. I. B. Lucas and W. K. McNaught of the Provincial Hydro Commission, together with Mr. Gaby, engineer, had a conference on October 5, with Premier Hearst and other members of the Ontario Cabinet with reference to power development at Niagara Falls. The proposed additional development is in the neighborhood of 100,000 horse-power, and the consultation, it is understood, had to do with financial and kindred matters associated with the enterprise. Premier Hearst, spoken to after the meeting, declared there had been merely a consultation, and there was no definite announcement to make.

English Firms Want Agents Here. — Many well-known manufacturing firms in the United Kingdom seek agents to represent them in Canada. To. C. Hamilton Wickes, British Trade Commissioner to Canada and Newfoundland, have come numerous requests for help in this matter. Mr. Wickes, who has been in the United Kingdom since last February to familiarize himself with trade conditions there since the war, has returned to Montreal. Members of Canadian manufacturing firms, desirous of obtaining new commercial connections with firms in the United Kingdom may obtain information as to appointments with Mr. Wickes by seeing T. B. Wainwright, chief clerk in the offices of the British Trade Commissioner, 3 Beaver Hall square.

Catalogues

Safety Valves for high and low pressure, and superheat, are illustrated and described in a bulletin issued by the James Morrison Brass Mfg. Co., Toronto, Ont. A price list is included for the different types.

Quality Fluxes is the title of a bulletin issued by the Reade Mfg. Co., Hoboken, N.J. The bulletin fully describes three of the company's principal products, the "Incomparable" soldering fluid, tinning solution and "Readina" soldering solution. The advantages to be gained by using these materials are dealt with in detail and a price list is included for various quantities.

Dart Unions.—The Dart Union Co., Toronto, Ont., have issued a 16-page booklet for the purpose of again bringing to the attention of the trade the "Dart" union pipe couplings and to point out some of the advantages to be had from their use. The principal features covering the construction of "Dart" unions are dealt with a complete line of fittings are illustrated and listed.

The Yawman & Erbe Mfg. Co., Rochester, N.Y., have issued an interesting booklet entitled the "Proper Place for Blue Prints and Drawings." The booklet deals with filing systems for blue prints and drawings, and illustrates a few cabinets for filing such matter, emphasizing the necessity of having drawings filed in such a manner that they can be found when required and also be preserved in good condition.

Shells and Shell Furnaces is the title of circular No. 140 just off the press and being distributed by Tate-Jones & Co., Inc., Pittsburg, Pa. The circular gives details of heating equipment for the forging, annealing, nosing, heat treating, banding, baking of shells, and annealing of cartridge cases for shells as called for by the specifications of various European Governments. The various types of furnace are illustrated and described in detail, and principal dimensions are included for the regular sizes.

Refractory Efficiency Engineering is the title of a 42-page booklet compiled by the Elk Fire Brick Co., of Canada, Hamilton, Ont. The booklet is divided into two parts. The first deals with the preparation and blending of clays, the manufacture of fire brick by various processes and other similar matter. Part two deals more particularly with the company's products and includes references to their equipment, brands, the engineering department and policy. A number of cuts are included showing standard and also some of the ordinary special shapes of fire brick. The concluding pages contain some useful mechanical tables.

Book Reviews

Commission of Conservation Sixth Annual Report.—Even casual reference to the annual reports of the Commission of Conservation indicates the wide range of interests with which the Commission is concerned. In this respect, the Commission's sixth annual report, which has just been issued, is no exception. Well-informed discussions are given concerning Canada's resources in forests, fields, mines and streams, and important papers are included on technical education, agricultural instruction, providing sanctuaries for birds and last, but by no means least, an important place is given to housing and town planning. Although the war has hampered some aspects of the work of the Commission, steady progress has been made in the matter of town planning. In the conservation of forests steady progress has also been made. Inventories of Canadian forests are being compiled by the Commission for the first time, and much has been done during the past year to lessen the number of forest fires along railway lines. The agricultural surveys and illustration farms operated for some years by the Commission have proved of such value that the Federal Department of Agriculture has recently taken over the work and is largely extending it. Canada's mineral resources are considered at length by Dr. Frank D. Adams, by Dr. Eugene Haanel and by Mr. W. J. Dick. In connection with water-powers, especially as applying to boundary waters, interesting and valuable papers by Messrs. A. V. White and Leo. G. Denis, are included in the report. The report is splendidly illustrated, and a carefully prepared index makes it of unusual value

Test Methods for Steam Plants, by Edward H. Tenney., 224 pages, 7¼ x 5 in., 85 illustrations. Published by the D. Van Nostrand Co., New York City. Price $2.50 net. This is a new book dealing with a phase of power plant operation which is not usually given the consideration that its importance demands. Economical operation of steam power plants can only be secured by the adoption of test methods to ascertain where losses are creeping in so that they can be eliminated as far as possible. This book has been written with the object of bringing into one volume those methods of analysis which can be used to good advantage in the power plant, and will aid the power station engineer in keeping his costs at the lowest figure. As the economical generation of steam depends largely on a suitable quality and supply of fuel and also on the correct design of the furnace, a considerable portion of the book is devoted to this phase of the subject. The remaining part deals more particularly with test-

ing of prime movers and lubricants. There are six chapters and an appendix. The first chapter on the purchase and testing of coal, deals, among other subjects, with the calorific value of coals and various methods of determination. The second chapter is devoted to the question of economical combustion. The treating and testing of water for boiler feed purposes is covered in chapter three which also describes several methods and appliances for treating water. Chapter four deals with evaporation tests in boilers and describes several methods and apparatus for testing flue gases. The fifth chapter, entitled "Methods of testing prime movers," is very comprehensive and describes methods of conducting tests and the apparatus used. The testing of power plant lubricants is described in the sixth chapter. Throughout the book are introduced a number of very useful tables, the last series Nos. 20 to 39 being included in the appendix. In addition to the main index there is an index of contents and lists of tables and illustrations. This book contains a lot of useful information for the power plant engineer of a kind that is not readily obtainable in the ordinary course of his duties.

CLASSIFIED ADVERTISEMENTS

¶ Those who wish to sell or buy a business, obtain competent help, connect with satisfactory positions, or secure aid in starting new enterprises should not fail to use the Want Ad. Page of "CANADIAN MACHINERY."

¶ If you want to sell or buy a second-hand lathe, planer or any other shop equipment, let "CANADIAN MACHINERY" pick out a seller or buyer for you. How about that second-hand engine or boiler which you would like to dispose of?

Rates (payable in advance):—2c per word first insertion, 1c per word subsequent insertion. 5c additional each insertion when Box Number is required. Each figure counts as one word.

FOR SALE

FOR SALE — FOUNDRY AND MACHINE shop, with lathes, shapers, drills, etc. Shop 90′ x 30′. Ten years old. Paris, Ont. Apply John Stewart, 203 William Street, Brantford, Ont.

FOR SALE—25 HORSE STEAM POWER, complete, consisting of portable firebox boiler and stationary engine in good running order. Will be sold at a bargain. Thos. F. Mullin, Chepstow P.O., Ont. (18)

WANTED

AGENTS—ENGINEER DESIRES TO REPRESENT manufacturing firms in Montreal and district on a commission basis. Apply G. S. B., care of Canadian Machinery, Montreal. (17)

WANTED—POSITION AS SUPERINTENDENT. Am open to consider the position of superintendent of any firm manufacturing war munitions. Have special knowledge of materials and have designed machinery and solved problems in connection with machining and forging shells. Have thorough understanding of operations. Am not looking for fancy salary. William Rodgers, A.M. Can. Soc. C.E., 1386 Delorimier Ave., Montreal.

Montreal, Que.—J. R. Walker & Co. paper manufacturing plant at Sault Au Recollet was destroyed by fire on Oct. 14, the loss being estimated at $25,000.

Tenders

Toronto, Ont.—Tenders will be received, addressed to the Chairman, Board of Control, City Hall, up to Tuesday, Nov. 9, 1915, for the supply of a radial drill for machine shop, Danforth avenue car barns. Specifications and forms of tender may be obtained at the Works Department, Room 12, City Hall.

Winnipeg, Man.—Tenders, addressed to the Chairman, Board of Control, will be received up to Wednesday, Oct. 27, 1915, for the following supplies for the Fire Department: 3,000 feet 2½-inch cotton, rubber-lined fire hose; 12 non-interfering fire alarm boxes. Specifications and forms of tender may be obtained at the office of the Chief of the Fire Department, Central Fire Station.

New Westminster, B.C.—Tenders will be received up till October 29, for an electric freight elevator for Public Building. Plans and specifications may be seen on application to the caretaker of the Public Building, New Westminster, B.C.; at the office of Wm. Henderson, Resident Architects, Victoria, B.C.; at the Post Office, Vancouver, B.C., and at the Department of Public Works, Ottawa.

Windsor, Ont.—Tenders, addressed to J. F. Smythe, chairman Water Commissioners, Windsor, Ont., will be received up to Saturday, October 23, for the building and installing at the Windsor water works pumping station of one 200 h.p. steel Scotch boiler—to carry 160 lbs. pressure according to specifications and blue prints on file at the office of the Water Commissioners, City Hall, Windsor, Ont.

Port Arthur, Ont.—Tenders for fittings, customs examining warehouse, etc., Port Arthur, Ont., will be received until Friday, October 29, 1915. Plans, specifications and form of contract can be seen and forms of tender obtained on application to the Department of Public Works, Ottawa, at the offices of Thos. Hastings, Clerk of Works, Postal Station "F," Toronto, Ont., and Wm. Hood, Architect, Port Arthur, Ont.

Berlin, Ont.—Tenders will be received by the Chairman of the Sewerage Committee until Tuesday, October 26, 1915, for furnishing and installing sewage pumping machinery, comprising: (a) Two turbine pumps and all piping, capacity 500 gallons per minute, 33 feet head. (b) Two a.c. motors, switchboard and electrical instruments, installed complete. Specifications may be seen at the Engineer's Office, City Hall, Berlin, or at the office of Chipman & Power, consulting engineers, 204 Mail Building, Toronto.

Ottawa, Ont.—Tenders will be received up to Tuesday, November the 23rd, for the undermentioned items for delivery to H.M.C. Dockyards at Halifax, N.S., and Esquimalt, B.C.: Steel and iron bolts, nuts and rivets, electric cable and wire, mineral grease, castile soap, hard soap, turpentine, chemicals, cleansing powder, bunting. Forms of tender and all information may be obtained by application to the Naval Store Officer at H.M.C. Dockyards at Halifax, N.S., or Esquimalt, B.C., or to G. J. Desbarats, Deputy Minister of the Naval Service, Ottawa.

Contracts Awarded

London, Ont.—The Canadian Moloney Co., have been awarded a contract for transformers by the city council.

Trenton, Ont.—The contract for furnishing steel work and substructure of bridge over Trent river was awarded by Dominion Government to the Ontario Bridge Co., Toronto, at about $132,000.

Winnipeg, Man.—The Minister of Public Works has let the contract for the furnishing of the steel library and vault fittings for the new law courts to the Winnipeg Ceiling and Roofing Co., their price being $4,600.

New Incorporations

The Great West Direct Power Engine Co., Vancouver, B.C., has been incorporated with a capital stock of $25,000 to manufacture engines, machinery, etc.

The Paste & Gum Co. has been incorporated at Toronto with a capital of $40,000 to take over the business of the Paste & Gum Co. at Toronto, Ont. Incorporators: Robert Ellis and Goldwin Larratt Smith, all of Toronto.

The Ontario Cartridge Co. has been incorporated at Toronto with a capital of $40,000 to manufacture ammunition of all kinds at Ford, Ont. Incorporators: John Henry French, Walter Frank Tant and Forrest M. Keeton, all of Detroit, Mich.

The Belmont Oil & Gas Co. has been incorporated at Toronto with a capital of $40,000 to engage in the business of refining and treating artificial and natural gas, petroleum at Belmont, Ont. Incorporators: Frank Blair Tomb and John Stephenson Cousins, of London, Ont.

CLASSIFIED ADVERTISEMENTS

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FOR SALE—25 HORSE STEAM POWER, complete, consisting of portable firebox boiler and stationary engine in good running order. Will be sold at a bargain. Thos. F. Mullin, Chepstow P.O., Ont. (18)

FOR SALE—CHEAP—ONE TWENTY-TWO-inch by ten feet bed Porter lathe, compound rest, steady rest, set change gears, large and small face plate, eighteen-inch four-jaw chuck, boring bar, four tool holders, and taper socket fitted. Box 156, Canadian Machinery.

BUSINESS FOR SALE—OWING TO ILL-health proprietor offers for sale his business, consisting of machine shop and blacksmith shop, with power hammer, tools, patterns and appliances used in the manufacture of artesian and oil well drilling tools and general work; will sell with or without buildings and land. Address Wm. Pratt, agent, Box 148, Petrolia, Ont.

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AGENTS—ENGINEER DESIRES TO REpresent manufacturing firms in Montreal and district on a commission basis. Apply G. S. B., care of Canadian Machinery, Montreal. (17)

WANTED—POSITION AS SUPERINTENDent. Am open to consider the position of superintendent of any firm manufacturing war munitions. Have special knowledge of materials and have designed machinery and solved problems in connection with machining and forging shells. Have thorough understanding of operations. Am not looking for fancy salary. William Rodgers, A.M. Can. Soc. C.E., 1386 Delorimier Ave., Montreal.

Personal

Lionel Hichens, chairman of Cammell, Laird & Co., has arrived in Ottawa to assume his duties as a member of the Shell Committee.

F. A. Skelton, director and secretary-treasurer of the Canadian Car & Foundry Co., Montreal, has left for New York on a business trip.

John Pugsley, at one time a member of the firm of Pugsley, Dingman & Co., soap manufacturers, Toronto, Ont., died in that city on Oct. 14, aged 63.

Hon. David MacKeen, of Halifax, N.S., at one time manager of the Dominion Iron & Steel Co., has been appointed Lieut.-Governor of Nova Scotia.

Charles Stewart, vice-president of Burrow, Stewart & Milne Co., iron founders, died at Hamilton, Ont., on Oct. 8. The deceased was born at Paterson, N.J., on Oct. 14, 1837.

W. W. Butler, vice-president of the Canadian Car & Foundry Co., Montreal, has left on an inspection trip, during which he will visit all the plants in the United States occupied on Canadian Car Co. orders.

Sir Hay Frederick Donaldson, K.C.B., recently appointed as technical adviser to the Shell Committee, has arrived in Ottawa. Sir Frederick Donaldson was until recently chief superintendent of Royal Ordnance Factories at Woolwich Arsenal.

George Cahoon, jr., has just been advanced from the vice-presidency of the Laurentide Co. to the presidency, to fill the vacancy caused by the death of Sir William Van Horne, and C. R. Hosmer assumes the vice-presidency. J. K. L. Ross was appointed to the vacancy on the board.

Charles Brewer Hunt, head of the milling firm of Hunt Bros., of the coal business bearing the same name, ex-president of the London Board of Trade, and one of the foremost business men of this city, died suddenly in London, Ont., on Oct. 11. The deceased was born at St. Thomas, 65 years ago. He was at one time actively associated with the London Electric Co., and was one of the pioneers of the milling industry in Western Ontario.

Walter Collis, manager of the Collis Leather Co., Aurora, Ont., died suddenly at the Western Hospital, Toronto, on Oct. 16. The late Mr. Collis was very well known in business circles. He was an expert in the manufacture of chrome leather, and for several years was engaged with the Davis Leather Co. of Newmarket. About three years ago, however, he severed his connection with the Newmarket concern and established the company of his name here. Deceased was 60 years of age.

Alexander Tropenas, inventor of the Tropenas converter, who died at Lyons, France, July 14, aged 55 years, served early in his career as a foreman in the plant of the French Bruges firm where he operated the Robert converter. Later he went to England to superintend the operation of the same converter for Edgar Allan & Co. at Sheffield. While there he invented his own converter, which he patented both in Great Britain and the United States. About 1901 he went to the United States to introduce his process for making small steel castings.

Trade Gossip

The Dominion Stamping Co., Walkerville, Ont., have recently installed a 5-ton electric traveling Northern crane manufactured by the Northern Crane Works, of Walkerville, Ont.

Ottawa, Ont.—The opening of a new transcontinental railway service was signalized by the departure on Oct. 12 of a Canadian Northern train of Pullman cars, bearing a party of senators and M. P.'s on an excursion trip to Vancouver, B.C.

Carriage Factories Ltd., who have plants at Montreal, Brockville and Orillia, have recently obtained large war orders for such articles as artillery harness, saddles, blankets, halters, ambulances, transportation carriages and water wagons.

Inverness Railway & Coal Co.—A receiver and manager of the Inverness Railway & Coal Co. has on the application of the National Trust Co., Toronto, trustees for the bondholders of the Inverness Railway & Coal Co., been appointed by the Court of Nova Scotia.

Rise in Custom Receipts.—An increase of over $2,000,000 in customs receipts is shown by the figures for September. Receipts totalled $8,029,665, as compared with $5,919,273 in September of last year, or an increase of $2,110,391. For the six months of the present fiscal year receipts have been $44,760,830, as compared with $43,044,913, an increase of $1,715,917.

Contracts Affected by Exchange.—The rate of exchange is reacting to the detriment of Canadian war contracts on this side. It is said that one contract for $50,000 fell through a few days ago solely on this account. It is felt that the Dominion Government should take steps to obviate the difficulty.

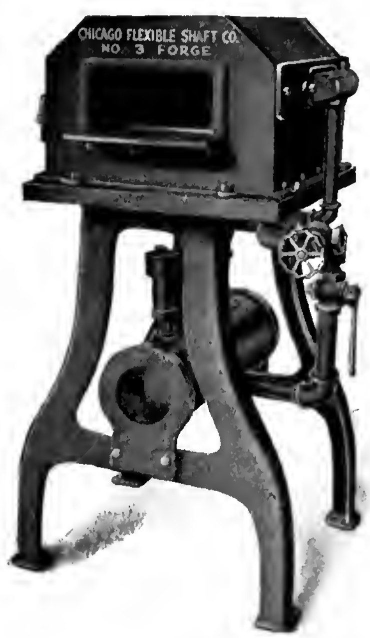
STEWART NO. 1 OVEN
Size of heating space, 5"x9"x13½".
Price with blower, $100.00.
Price without blower, $75.00.

Perfect Control Makes Tool Hardening Sure

A Stewart Forge or Furnace is always under the absolute control of the operator. He can get any heat quickly and hold it accurately without any wavering above or below. There is no guessing, no trusting to luck, no uncertainty about the result. He can heat every piece or lot exactly according to the grade of steel and to the purpose for which it is intended. As a result steel heating becomes an *exact* science when you use Stewart Furnaces; and spoilt work is reduced to a minimum.

Stewart Oven Furnaces, except those built for assaying and enameling, are made without muffles; have no need of them.

The Stewart line includes over 100 stock styles and sizes and the patterns of many special designs for various purposes. In this wide range there is one style and size which will exactly meet your needs. Let our service department help you find it. We will ship it on 30 days' approval. Write for catalogue 56.



No. 3 FORGE
Front opening, 3½"x8".
Rear opening, 3¾" diam.
(Rear opening same as front, if specified.)
Depth of heating space, 10".
Price with blower, $65.00.
Price without blower, $10.00.

Chicago Flexible Shaft Co.

210 to 230 Ontario St., Chicago, Ill.

The W. T. Rawleigh Co., who have a large factory at Freeport, Ill., and plants also at Memphis, Tenn., and Winnipeg, Man., will build a factory at Hamilton, Ont., on Rosslyn avenue. The company manufacture proprietary medicines, extracts, spices, toilet articles, stock remedies, disinfectants, etc. The first building will be 120 feet long by 60 feet deep, and five storeys high. Work will be started shortly, and Hamilton will be Canadian headquarters.

Halifax, N.S.—A petition for the winding-up of the Nova Scotia Car Works, was presented to the Supreme Court, on Oct. 15. It was ordered that the petition come up on Oct. 29 before the judge presiding at Chambers. Notice is given on behalf of the company that on Oct. 29 an application will be made for an order appointing the Eastern Trust Co., liquidator, that company having to-day been appointed liquidators. The plant is now engaged on an order for the 200 cars for the I. C. R.

Canadian Flour Mills Busy—Canadian milling companies have entered on another year under favorable auspices. Practically all mills are working to capacity now, and they have orders on their books from British and Foreign Governments that will keep them fully employed for at least two months to come. Two mills share in one Government order for 140,000 bags of flour. Certain mills are operating day and night. It is interesting to note, too, that Minneapolis mills in order to fill export orders have purchased considerable quantities of Canadian flour.

Dominion Development Commission—It is understood that Senator J. A. Lougheed, will be chairman of the Commision to be appointed by the Government to study a scheme of Canadian national development, with special reference to present conditions. It is further learned that William Smith, the member for South Ontario, and a well known stock breeder; J. C. Watters, the prominent labor man, of Ottawa; J. W. Flavelle, of Toronto; Dr. J. G. Rutherford, former Veterinary Director-General of Canada, and E. N. Hopkins, of Moose Jaw, a well known member of the Grain Growers' Association, have all been named as members of the commission, while other appointments are expected to be announced shortly.

Tenders Received on Big Pulp Limit.—The Ontario Government has received several tenders in response to its decision to offer for sale the Lac Seul or English River pulp limits north of Kenora. The limits were advertised some time ago, and offers were to be based upon strict conditions as to capital investment and paper output, similar to those imposed on the company that is now operating the immense plant at Iroquois Falls and turning out two hundred tons of print paper a day. Hon. G. Howard Ferguson, Minister of Lands, Forests and Mines, is now considering the tenders.

Lake Superior Corporation.—At the annual meeting of Lake Superior Corporation held last week the following were elected directors: Walter K. Whigham, Frederick McOwen, John T. Terry, Herbert Coppell, J. S. Dale, H. I. Underhill, W. E. Stavert, W. C. Franz, Alex. Taylor, James Hawson, A. H. Chitty and Thomas Gibson. At the meeting of the board, following the shareholders' meeting, officers were elected as follows: Chairman of board, W. K. Whigham; president, W. E. Stavert; vice-president, Herbert Coppell, W. C. Franz and James Hawson; secretary, Alex. Taylor; treasurer, James Hawson.

Mussens Ltd. Affairs.—Exchange of about $35,000 worth of stock for cash or bills receivable, without reduction of estimated surplus to creditors, is an encouraging note in a statement issued by the liquidator of Mussens Ltd. The six months extension granted by the court has just expired, and application will be made for further extension, as the showing made during the past six months would seem to warrant it. Of $131,000 bills receivable, $81,000 has been collected, and a considerable portion of the remainder is considered good. Stock amounting to $209,000 remains on hand, but can likely be sold for full value if time is given to do so. The liability to the bank is materially reduced, and a 10 per cent. dividend has been declared for the benefit of ordinary creditors. The liquidator, J. J. Robson, estimates that there is a surplus of $183,000, as assets exceed liabilities by that amount. Among the assets is an item of $66,750 equity in property in Montreal and other cities.

Catalogues

Plastic Boiler and Furnace Linings.—The C. B. Turner Co., Toronto, Ont., have issued a booklet dealing with plastic linings for boilers and furnaces. Directions for applying this lining are given and a list of users is included.

The Precision Instrument Co., Detroit Mich., have issued a set of bulletins describing an interesting line of measuring and recording apparatus for flue gases, etc. The bulletins deal successively with the Parker Co. machine, the "Simmance & Abady" combustion recorder, the "Simmance & Abady" "Precision" pressure and vacuum recorders

and indicators, "Precision" gauges, "Precision" efficiency kit, "Wright's" boiler tester and "Orsat" apparatus, the "Roland Wild" calorimeter, "Precision" water meter, "Simmance & Abady" encased thermometers. The principal features and method of operation of each apparatus are described fully especially as regards the CO_2 combustion recorder which is dealt with at considerable length. The bulletins contain price lists and code words and are fully illustrated. They are gotten up in an attractive manner and are bound together in a loose leaf folder.

Refractory Efficiency Engineering is the title of a 42-page booklet presented to the firebrick trade by the Elk Firebrick Co. of Canada, Hamilton, Ont., with the idea of bringing to the attention of the consumer a few facts concerning firebrick that it is hoped will prove beneficial to all concerned. The booklet is arranged in two parts. The first contains a brief description of the manufacture of firebrick from the mining of the fire-clay to the selling and loading of the products, including a description of the various processes. The second part deals more particularly with the company's products and includes references to the clays and equipment used, brands of firebrick and methods of sorting. Mention is also made in this section of the company's engineering department and policy. A number of ordinary special shapes are illustrated with their dimensions, while the concluding pages contain a number of useful mechanical tables for the trade.

Book Reviews

Northern Pacific Ports is the title of a book compiled and published by the Terminal Publishing Co., Inc., San Francisco, Cal. This is the second edition and the contents consist of useful marine, exporting and importing information for Alaska and the western coasts of Canada and the United States. The book contains a great deal of useful information for shipping concerns, traders, port authorities, etc. Brief mention of some of the subjects dealt with will give an idea of the scope of this publication. These are as follows:—Navigation laws of the United States, particulars of the various ports along the seaboard of the North Pacific including their harbor rules and regulations, list of transportation companies and their fleets, matters pertaining to Canadian and United States customs, currency tables, Rule of the Road at Sea, etc. The book contains 44 pages of reading matter printed in clear type with index and is bound in substantial cloth covers.

Thread Milling Machines

For High Explosive Shells

Designed for the purpose of milling the thread in the base and nose of high explosive shells.

Shell is placed inside a revolving spindle and is self-centering. A perfect thread is produced in base of shell in approximately 2½ minutes.

Milling Cutter is made from best high-speed steel, by Brown & Sharpe, from special design by Holden-Morgan Co., and is so shaped that it can be sharpened without changing the form. Cutter is designed to mill the top of thread as well as the depth.

Machines are fully equipped for work, including oil pump. Fitted with automatic stop motion, which stops machine when thread is completed. One operator can run several machines. Eliminates all risk of having shells rejected on account of thread being stripped, as is liable to be the case when tapped by the old method.

Write for complete particulars, prices, etc.

THE HOLDEN-MORGAN CO., Limited

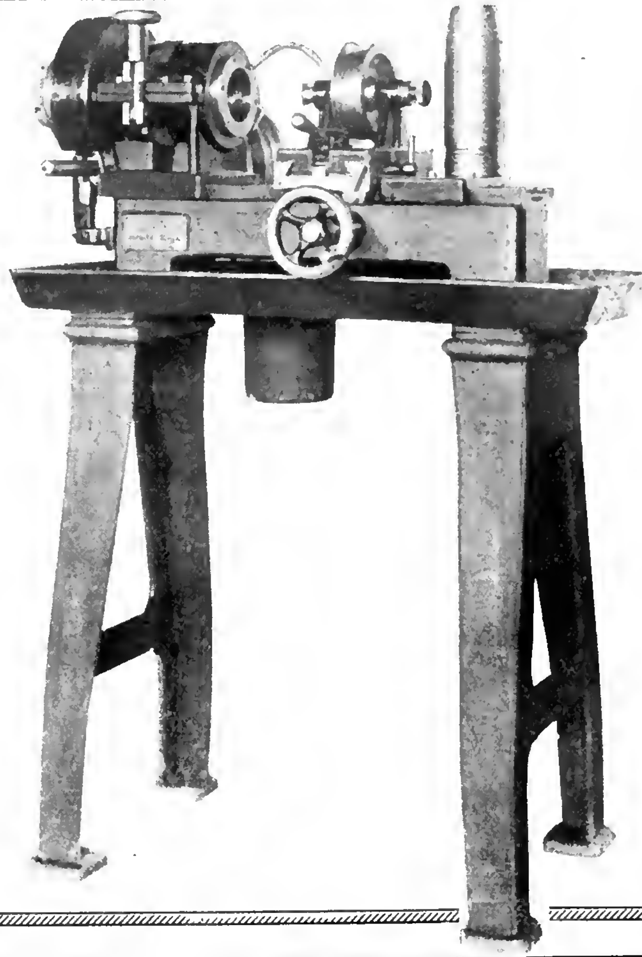
539 Richmond Street West, Toronto, Canada

SALES AGENTS:

The A. R. Williams Machinery Company, Limited

Toronto, Ontario

IF IT'S MACHINERY—WRITE "WILLIAMS."



Thousands of Threaded Pieces Each Day with a Geometric Threading Machine

RAPID AND PERFECT DUPLICATION

Takes floor space 2 ft. x 3 ft., and is complete with countershaft, change speed gear for adapting speed of spindle to diameter to be threaded; adjustable stop for gauging length of work.

No rough threads with the Geometric. They are as true and clean as can be produced by any screw machine.

Note the range:—Regularly, ¼-in. to ¾-in. Specially, ½-in. Std. pipe threads; ⅞-in. S.A.E. Std. Spark Plug threads, and up to 2-in. Diam. threads where the pitch is fine. Internal threads, ⅛-in. to 2-in.

Send in your Specifications and learn what we can do for you.

THE GEOMETRIC TOOL COMPANY

NEW HAVEN, CONN., U.S.A.

Canadian Agents: Williams & Wilson, Ltd., Montreal; The A. R. Williams Machinery Co., Ltd., Toronto, Winnipeg and St. John, N.B.

at $24.50, f.o.b. Pittsburgh. Wire rods are higher at $32 Pittsburgh.

Pig Iron

A large tonnage of low phosphorus pig iron is being imported from the States for steel making. Foundry grades are not so active but have advanced in price. Hamilton and Victoria brands are now quoted at $21 per ton, Toronto. Standard low phosphorus is being quoted $26 at furnace.

Old Material

The market is dull, there being little demand for domestic material with the exception of aluminum, which is very scarce. Buying is of a speculative order and consumers are slow in taking deliveries. Prices are firmer and higher for some materials. Scrap copper has advanced 25c to 50c per 100 lbs. according to grade. No. 1 composition turnings are now quoted at $10. Heavy melting steel is in fair demand and has advanced to $9.50, while machinery cast iron is also higher at $12.

Machine Tools

There is little change to note in the machine tool situation although there will be considerable activity when the orders for the larger calibre shells have been placed. Tenders are being submitted by manufacturers for these shells and the orders will no doubt be placed with as little delay as possible. The shells will be 6-in., 8-in. and 9-in., and heavy lathes will be required to machine them. There is still a steady although lighter demand for tools for 18-pdr. shells, together with a fair movement in second-hand equipment.

Supplies

There is a general upward tendency in prices, and a number of changes have to be noted this week. Discounts on twist drills have been revised. Carbon drills up to 1½ in. are now 55 p.c. and blacksmith 55 p.c. French medal glue is lower at 15c per pound. Gasoline has advanced 2c and is now quoted at 20c per gallon in barrel lots, while benzine is also higher at 18½c per gallon. Owing to a shortage in supplies, turpentine has advanced 5c and is now quoted at 70c. Linseed oil is also higher at 77c for raw and 80c for boiled oil. Plumbers' oakum is being quoted at $4.25 per 100 lbs., and lead wool is now 11c per pound. Business in supplies for shell plants continues active.

Metal Market

The metal market is dull, but prices are keeping steady. The sterling exchange situation, although somewhat easier, continues to have a depressing effect on the metal market. The New York market has been more active recently and is showing a tendency to react in an upward direction. The London market is quiet and steady. The scarcity of aluminum continues and prices have an upward tendency. Spelter is a little higher due to strength in both London and New York. The copper market is easier but, with the recent large new orders for munitions, a buying movement is expected with a possible advance in price. The tin market is firm but unchanged. Antimony and lead are firm but unchanged.

Tin.—The market is firm but quiet. The uncertainty of the British export-tax question has restrained activity and probably prevented a good movement. Tin is unchanged at 37c per pound.

Copper.—The market is dull and easier but prices are unchanged. The copper position, however, is a strong one as large orders for munitions continue to be placed which will result in a heavy demand for this metal. Consumers are buying on a hand-to-mouth basis, but may be forced to cover their requirements in a rising market. Producers seem to be in control of the situation, and, as copper must be had by munition manufacturers, higher prices are therefore more probable than otherwise. Locally copper is unchanged at 19½c per pound.

Spelter.—The market is higher both in London and New York, and the situation has improved. Spelter has advanced ½c locally and is now quoted at 17½c per pound.

Lead—The market is firm with the "Trust" price at $4.75 New York. Local quotations are unchanged at 6¼c per pound.

Antimony.—The market is very firm, and there is a scarcity of spot metal. Quotations are unchanged at 35c per pound.

Aluminum.—Prices are nominally unchanged, but the scarcity of this metal is rather more apparent, and holders are inclined to ask higher prices. Local quotations are nominal at 60c per pound.

ALLIES PURCHASING AGENTS

The Trade and Commerce Department, Ottawa, has published the following list of purchasing agents for military purposes for the allied Governments:

International Purchasing Commission, India House, Kingsway, London, Eng.

French.—Hudson Bay Co., 56 McGill Street, Montreal; Captain Lafoulloux, Hotel Brevort, New York; Direction de l'Intendence Ministere de la Guerre, Bordeaux, France; M. De la Chaume, 28 Broadway, Westminster, London.

Russian.—Messrs. S. Ruperti and Alexsieff, care Military Attache, Russian Embassy, Washington, D.C.

St. John, N.B., October.—Industrial conditions in the Eastern provinces appear to be of a satisfactory nature, holding out much promise for the approaching winter, although there is no effort at expansion in any particular line. The only new extensions being instituted by established companies are for the manufacture of war supplies, and it is hoped that before next spring more orders will be received, if orders are still necessary for the success of the allied arms. The foundries in which shell manufacture is going on are for the most part working night and day in their efforts to expedite the output.

A new lumber mill at Nelson, on the Miramichi River, is to be erected this fall by Frasers, Ltd., according to a recent announcement. It is understood that the firm plans to expend between $80,000 and $100,000 on the new plant.

A new steel bridge at Grand Falls, the gully near the C. P. R. station, is to be erected. Plans and specifications are to be made this winter.

Local manufacturers and members of industrial concerns were instrumental in the success of a big endeavor recently held here—"a $50,000 patriotic auction" in the interests of the patriotic fund. They donated freely towards the movement, the gifts being sold and the profits going to the fund. Among the more interesting articles offered for sale were a number of nickel-plated shrapnel shell electric table lamps, these having been donated by the Phoenix Foundries.

CANADIAN CROP REPORT

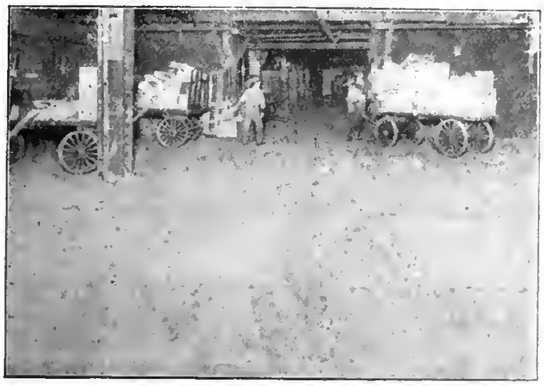
THE immensity of Canada's wheat crop this year is shown by the report sent out on October 15. For wheat, oats, rye and flax the yields are even higher than those reported a month ago, but in the case of barley and oats the present estimate is less than that of August 31st.

The total wheat crop of Canada is now placed at 336,258,000 bushels from 12,986,400 acres, representing an average yield per acre of 25.89 bushels. This total is 174,978,000 bushels more than last year's inferior yield of 161,280,000 bushels, the crop this year being, therefore, more than double, or 108 per cent. more than that of last year. It is 104,541,000 bushels, or 45 per cent. in excess of the previous highest yield of 231,717,000 bushels in 1913, and 140,232,000 bushels or 72 per cent. in excess of the annual average yield of 196,026,000 bushels for the five years, 1910 to 1914.

JOHNS-MANVILLE SERVICE COVERS THE CONTINENT

JOHNS-MANVILLE stands for a new order of Service—service that concerns itself with your problems and their solution—a service that is as responsible in fact as it is in name because it is backed up by J-M Responsibility.

The oldest genuine asphalt street in your town will show you how J-M Mastic Flooring lasts



U.S. Express Room, La Salle St. Station, Chicago, J-M Mastic Flooring. Graham, Burnham & Co., Architects, Chicago.

J-M Waterproof Mastic Flooring wears, because its basic material is Trinidad Lake Asphalt, which has stood the test of city street traffic for nearly fifty years. There is practically no wear-out to it in shop floor service.

J-M Mastic Flooring is as "springy" as wood. It can be laid in any consistency from hard-as-oak to soft-as-pine, according to requirements. It wears like iron, but is unlike flooring made of perfectly rigid material. It is absolutely dry, easy under foot, slip-proof and noiseless.

This flooring originates no dust to damage goods or injure machinery and, as it is waterproof, it can be cleaned and kept in sanitary condition by flushing. Acids and alkalies have no effect on it. Easily patched when resetting of machinery makes patching necessary. Can be applied over any stable foundation, anywhere, or over flooring now in place.

Let our flooring specialists see you about *your* floors.

J-M Asbestos Built-up Roofing is weather-proof, fire-resistant, non-corrosive and time-defying

This is not mere "selling talk," it is a statement of fact backed up by the performance of hundreds of J-M Asbestos Built-up Roofs in effective service for many years and still good for as many more.

The base of our built-up roofing is J-M Asbestos Ready-Roofing, even one ply of which would be practically as permanent as the brick walls or any other inorganic part of a building except for wind pressures, roof movement, damage from rough usage, etc. When built up by three- and four-ply laminations into thicknesses capable of resisting such strains, it furnishes a strong, light-weight, smooth-surface, practically fireproof roofing that never needs painting or any other attention and is bound to give perfect roofing service for a maximum period under the rule of J-M Roofing Responsibility. J-M Asbestos Built-up Roofing is examined, approved and labelled by the Underwriter's Laboratories, Inc., under the direction of the National Board of Fire Underwriters. It is given class "A" rating when laid over non-combustible roof decks having inclines not exceeding 3 inches to the foot and secures class "B" rating when laid over non-combustible roof decks having inclines not exceeding 6 inches to the foot.

Canadian Pacific Railway, Train Sheds, Windsor St. Station, Montreal, J-M Asbestos Roofings. The Dominion Bridge Co. and Geo. A. Fuller Construction Co., Contractors.

The Canadian H. W. Johns-Manville Co., Limited

Toronto Montreal Winnipeg Vancouver

330

Of oats, the revised total yield is 181,035,500 bushels from 11,365,000 acres, an average per acre of 42.33 bushels.

Barley comes out at 50,868,000 bushels from 1,509,350 acres, an average per acre of 33.70 bushels.

Rye is now 2,478,500 bushels from 112,300 acres, or 22.07 bushels per acre, and flaxseed 12,604,700 bushels from 1,009,600 acres, or 12.48 bushels per acre.

In the three North-west provinces, the estimated yield of wheat is 304,200,000 bushels, and of oats 305,680,000 bushels.

The remaining grain crops of Canada, whose yields are now reported on for the first time this year, are as follows: Peas, 3,240,400 bushels; beans, 594,000 bushels; buckwheat, 8,101,000 bushels; mixed grains, 17,128,500 bushels, and corn for husking, 14,594,000 bushels.

The condition of wheat, oats, grain varies from 90 and 93 per cent. of the standard quality fixed at 100.

ONTARIO MINES OUTPUT

THE output of the metalliferous mines and works of Ontario for the six months ending June 30, 1915, as reported to the Ontario Bureau of Mines, is shown by the following table, which also gives the production for the corresponding period of last year:

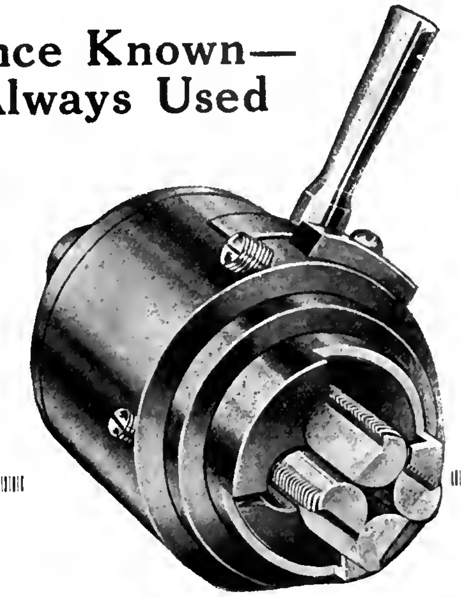
	6 months 1915	6 months 1914
Gold	$3,570,072	$2,011,069
Silver	5,188,763	7,053,418
Copper	1,229,894	1,197,059
Nickel	3,393,528	2,872,843
Iron Ore	288,296	118,119
Pig iron	2,856,040	4,429,664
Cobalt	34,443	22,581
Cobalt oxide (including nickel oxide)	56,812	379,152

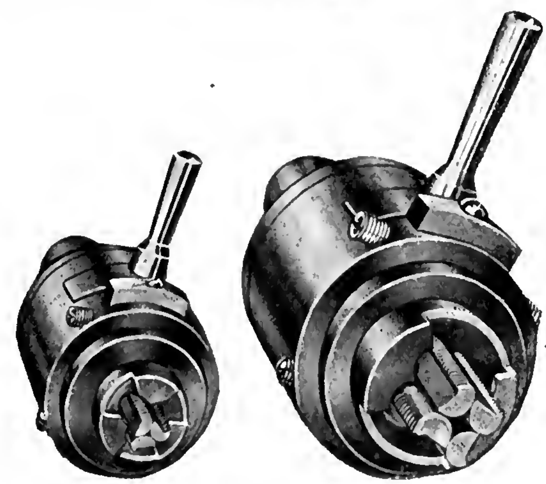
PAPER TRADE EXPANSION

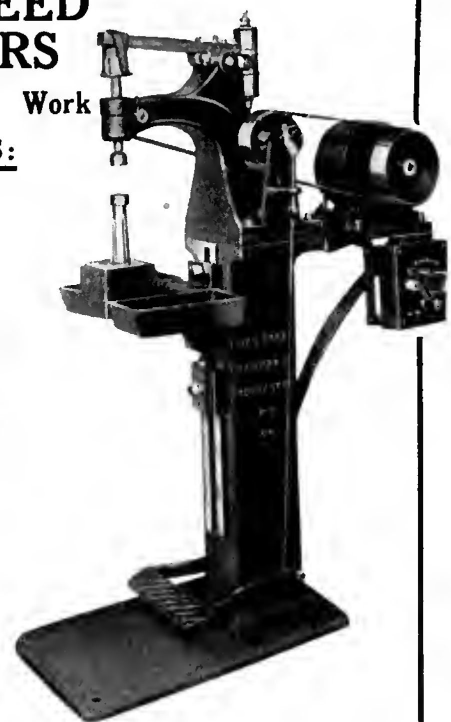
THE Canadian pulp and paper industry is evidently prospering. Since the opening of the current fiscal year exports to the United States especially have grown. July Government returns show exports of newsprint to the United States of $1,274,000. The export business of Canadian mills for the first four months, April to July, aggregated $5,098,799, of which the United States accounted for $4,589,144.

While the total compares with $4,213,000 in 1914, only $2,176,000 went across the border that year. As an indication of recent growth, this year's business so far is almost equal to eight months' business in 1913, and surpasses eight months' business in 1912, the total then being only $3,110,000. While the United States is Canada's best customer, the statement points out that another encouraging feature of the trade is the growing trade within the Empire.

For the fiscal year 1913-14 the total exports were $8,030,000, for 1914-15, $12,600,000, while the rate of the four months this year is between $15,000,000 and $16,000,000 per annum.







INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

St. Mary's Ont.—The Maxwell Works have received a large order for plugs for shells.

Vancouver, B.C.—The British Columbia Electric Railway Co. will make extensions to its cable plant.

Fort William, Ont.—The Canadian Car and Foundry Co. have started construction work on a new foundry.

London, Ont.—The George H. Belton Lumber Co. are considering installing electric motors for driving the machinery.

Sarnia, Ont.—The Imperial Oil Co. are installing several new steel tanks, the largest will have a capacity of 40,000 barrels of oil.

Chatham, Ont.—Bids will be called for shortly by the city council for a boiler to replace the present electric light plant boiler. W. G. Merritt is clerk.

London, Ont.—E. Leonard & Sons contemplate the installation of electrical drive in its plant for operating lathes, planing machines, etc.

Montreal, Que.—The Canadian Gas Co. are in the market for a large quantity of 6-in. pipe line in connection with the natural gas development at St. Hilaire.

Victoria, B.C.—The Imperial Oil Co., which has a plant at Burrard Inlet, B.C., is building an island headquarters plant at Victoria, B.C. Work is going ahead on a wharf, seven tanks, a boilerhouse, warehouse, etc.

Montreal, Que.—The Nicholson Constructions Co. are building machine shops on St. Patrick Street for the Canadian Tube & Iron Co. and the Colonial Wire Manufacturing Co. The cost is estimated at $13,000.

Hamilton, Ont.—A temporary heating plant, to cost about $5,000, will be installed at the Mountain Hospital by the city council. Later a permanent plant will be constructed at a cost of $30.000. Plans will be prepared at once.

Walkerville, Ont. — The Dominion Stamping Co., are erecting an additional plant here. The building will be of steel construction and will comprise a die shop, hammer shop and machine shop. The cost is estimated at $100,000.

Vancouver, B.C.—It is reported that a large quantity of shells will be allotted to firms in this district. The Vancouver Engineering Works will distribute 300,000. The Victoria Machinery Depot will have 200,000, and 150,000 will be made in New Westminster.

Sherbrooke, Que.—The contract for the proposed gas plant has been awarded to the Western Gas Construction Co., for $30,980. The specifications, however, will be revised and submitted to Mr. Mann, of the Montreal Light, Heat & Power Co., for approval and further suggestions before the work is proceeded with. Ald. Brault is chairman of the Gas and Electric Committee.

Port Moody, B.C.—The clearing of the nine and one-half acre site on which the plant of the Port Moody Steel Works is to be erected has already been commenced. The site of the plant is approximately three-quarters of a mile north of the business centre of the town, at the head of the Inlet and adjacent to the North Arm line of the C. P. R. The city will guarantee the bonds of the company to the extent of $100,000.

Chatham, Ont.—At a meeting of the directors of the Dominion Sugar Co., of Wallaceburg, held here on Oct. 21, it was decided to start at once the erection of a million-dollar beet sugar factory in this city. The directors have been assured by representative citizens of Chatham that the city will pass a by-law granting the company a free site worth $18,000 and annex the property to the city and provide other minor inducements.

Electrical

Attwood, Ont.—The Elma Township Council are considering installing a hydro-electric system.

Weston, Ont.—Plans for the extension of the local Hydro system to Thistletown were completed at the meeting of the Weston Water, Power & Light Commission held on Oct. 19. The scheme has received the approval of the Etobicoke Township Council, and the work will start within a few days.

Municipal

Kingston, Ont.—The Board of Works has decided to call for tenders for a concrete and asphalt mixing plant.

Beverley Township, Ont.—The township council have decided to build an electric power plant to cost $5,000.

Watrous, Sask.—A by-law will be voted on shortly to authorize the expenditure of $3,000 on water main extensions.

Montreal, Que.—The erection of a transformer building at the Low Level pumping station is being considered by the City Council. Tenders will probably be called shortly.

Sarnia, Ont.—At a recent meeting of the City Council a communication was read from the Sarnia Gas & Electric Light Co., offering to sell their electric light plant to the city for $175,000.

Port Moody, B.C.—The ratepayers have carried a by-law to guarantee the debentures of the Port Moody Steel Works to the extent of $100,000. The construction of the company's plant and rolling mills will be commenced shortly.

Niagara Falls

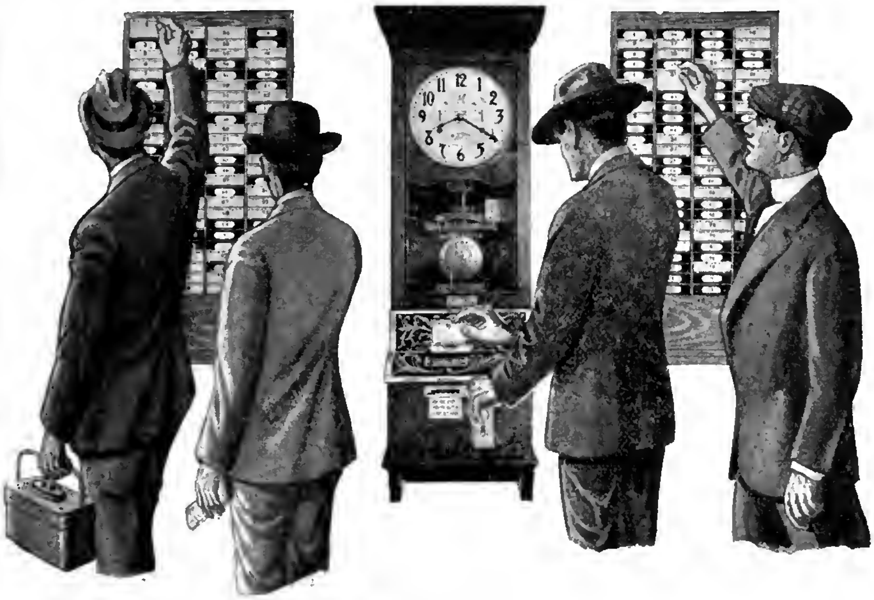
~~Welland~~, Ont.—A by-law will be submitted to the ratepayers on November 3rd providing for the purchase of power from the Hydro-Electric Commission and for the issue of debentures to the amount of $14,000 for machinery and equipment for the town electric station.

Windsor, Ont.—A company is being formed to build a waterworks system at Tecumseh at a cost of about $25,000. Part of the cost has been subscribed and the Government will be asked to issue a charter under the name of the Tecumseh and District Waterworks Corporation.

Midland, Ont.—The eastern end of James Playfair & Co. lumber yard at the waterfront, containing about 10,000,000 feet of lumber, was burned on Oct. 24. The fire also burned the coal dock underneath the coal for about 100 feet, the coal sliding into the bay. The estimated loss is $325,000.

Orillia, Ont.—The Town Council have decided to submit a by-law to the people on November 17 to raise by debenture $50,000 for the purpose of reconstructing the municipal building recently destroyed by fire. The new building will cost approximately $70,000, of which $20,000 is on hand from insurance.

Sarnia, Ont.—At a meeting of the City Council, held recently, the hydro-electric by-law and the by-law to provide for the purchase of the Electric Light Co.'s



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We also make highest quality Dial Time Recorders. Prices $85 and up.

AMALGAMATED AMMUNITION - - MACHINERY

Does the work fast and beautifully
Quick deliveries guaranteed

A complete line of machinery in two sizes for all roughing and finishing operations in the manufacture of all sizes of High Explosive and Shrapnel shells from forgings or bar stock.

Amalgamated Ammunition machines are especially designed for their purpose, but will be found of permanent value in any shop which handles repetition work.

Owing to the ingeniously simple and strong design of our machines and the special provision which has been made by our fine organization for quantity production, we can guarantee attractively quick deliveries.

TO FACILITATE FULL RESPONSE TO INQUIRIES, PLEASE GIVE ALL POSSIBLE DETAILS OF YOUR REQUIREMENTS.

Amalgamated Machinery Corporation

72 West Adams Street, Chicago, U.S.A.

plant were given first and second readings. It was also decided that the vote of the ratepayers on the hydro-electric by-law be taken at the municipal elections in January.

General Industrial

Victoria, B.C.—The Victoria Chemical Co. will build an addition to their plant at the Outer wharf.

Redcliff, Alta.—The Alberta Pacific Grain Elevator Co., of Calgary, may build a new elevator here.

At. Ann's, C. B. — The Cape Breton Pulp Co., whose plant was recently destroyed by fire, will rebuild immediately.

Windsor, Ont.—The National Spring & Wire Co., are considering the erection of a new plant adjoining the present building. The firm make cushion springs for automobiles.

Hespeler, Ont.—A Buffalo, N.Y., concern propose establishing a plant here for making refrigerators. The company will occupy part of the plant of the Stamped Enamelled Ware Co.

Verdun, Que.—J. P. Cote, of Maisonneuve, will build a shoe factory here at a cost of $25,000, exclusive of the site. A by-law will be voted on to grant exemption of taxes and a low rate for power.

Picton, Ont.—The apple evaporator owned by L. K. Shourds at the Village of Wellington, was destroyed by fire on Oct. 18. The building and nearly all the contents were a total loss, with no insurance.

Brantford, Ont.—The Brantford Cordage Co. has commenced building operations on an addition, which will double the present capacity. The entire plant will be operated by electric power. The company will also erect a plant at Winnipeg.

Personal

W. B. Redfern, town engineer of Steelton, Ont., has resigned.

John C. MacDonald, former president of the MacDonald-Godson Co., iron founders and structural steel, died on Oct. 5 at the age of 66.

Capt. Thomas C. Irving, of the 2nd Field Company of Canadian Engineers, and vice-president of the Robert W. Hunt Co., Toronto, has been promoted to the rank of major.

D. M. Medcalf, chief inspector of boilers for the Province of Ontario, has returned to Toronto from an extended visit to the West, and also to the Panama-Pacific Exhibition at San Francisco, Cal.

Tenders

Toronto, Ont.—Tenders for lead covered cable, addressed to the chairman of the Toronto Electric Commissioners, will be received until Tuesday, November 16, 1915. Specifications and form of tender can be obtained at the office of the purchasing agent, 15 Wilton avenue.

Toronto, Ont.—Tenders will be received, addressed to the Chairman, Board of Control, City Hall, up to Tuesday, November 9, 1915, for the supply of a radial drill for machine shop, Danforth Avenue car barns. Specifications and forms of tender may be obtained at the Works Department, Room 12, City Hall.

Toronto, Ont.—Tenders will be received, addressed to the Chairman, Board of Control, City Hall, Toronto, up to Tuesday, November 9, 1915, for the supply and erection of valves, steam piping, special steel castings and lagging, for main pumping station. Specifications and forms of tender may be obtained at the Works Department, Room 12, City Hall.

Ottawa, Ont.—Tenders will be received until Wednesday, November 10, 1915, for the construction of steel gates, towers and operating machinery for the regulating dam, Big Chaudiere Falls, French River, Ont. Plans and form of contract can be seen and specification and forms of tender obtained at the Department of Public Works, Ottawa, and at the offices of the District Engineers, Confederation Life Building, Toronto, and Shaughnessy Building, Montreal.

Ottawa, Ont.—Tenders will be received up to Tuesday, November the 23rd, for the undermentioned items for delivery to H.M.C. Dockyards at Halifax, N.S., and Esquimalt, B.C.: Steel and iron bolts, nuts and rivets, electric cable and wire, mineral grease, castile soap, hard soap, turpentine, chemicals, cleansing powder, bunting. Forms of tender and all information may be obtained by application to the Naval Store Officer at H.M.C. Dockyards at Halifax, N.S., or Esquimalt, B.C., or to G. J. Desbarats, Deputy Minister of the Naval Service, Ottawa.

Contracts Awarded

Montreal, Que.—Masson Co., of Quebec, will supply the steel work for the Star Boiler and Radiator Co.'s new factory.

Esquimalt, B.C.—The contract for the construction of an oil storage plant for the Imperial Oil Co. has been let to the Taylor Engineering Co., Vancouver, at $40,000.

St. Lambert, Que.—The Town Council has awarded the contract for ornamental street lighting to G. M. Gest, of Montreal, at $4,250. E. Drinkwater is town engineer.

London, Ont.—The contract for the steel work for the new shops for the London and Port Stanley Railway has been let to McGregor & McIntyre, Toronto, at $10,000.

Markham, Ont.—The contracts for the new waterworks scheme have now almost all been awarded. The National Iron Works have been given the contract for the pipes, hydrants and valves. The Pittsburg and Desmoines Steel Co. are to erect the elevated tanks at a cost of $5,750. The contract for pipe laying has not yet been awarded.

Trade Gossip

Welland, Ont.—The Electric Steel & Metals Co. will install a 6-ton Heroult furnace for making steel castings.

St. Thomas, Ont.—The local plant of the Canada Iron Corporation has received an order for a large number of iron plugs for shells.

The Morgan Engineering Co., Alliance, Ohio, have sold a 60-ton double trolley ladle crane to the Algoma Steel Corporation, Sault Ste. Marie, Ont.

The Northern Crane Works, of Walkerville, Ont., report the sale of several electric traveling cranes to the Consolidated Mining & Smelting Co., at Trail British Columbia.

The Canadian Bridge Co. has been incorporated at Ottawa with a capital of $2,000,000 to take over the structural steel business of the Canadian Bridge Co. of Walkerville, Ont., a provincial corporation.

The Canadian Fairbanks-Morse Co. will conduct their machine tool department from the Toronto office on Front Street. F. W. Evans has been transferred from Montreal, and will continue in charge of this department.

Galt, Ont.—The Galt Machine Screw Co., are about to commence the construction of a new factory. The building will be of mill construction with brick walls, and concrete basement and floors. The plant will be one of the best equipped in the province, and will be completed about the end of this year. Mr. Jansen is the general manager.

Chippawa, Ont.—The Norton Co. will erect a new electric furnace abrasive plant for the manufacture of alundum adjacent to their crystolon plant. The plant will consist of an office building, a building for housing the electric furnaces, mixing and storage bins, etc., and a reinforced concrete storage building. Six electric furnaces will be installed at once with a 15-ton overhead travelling crane, motors and other electrical equipment.

Building Notes

Montreal, Que.—The Canadian Iron Tube Co., have obtained a permit for the erection of a building in Hamilton to cost $2,000.

Montreal, Que.—A permit has been issued to the Thos. Davidson Mfg. Co., for the erection of a factory extension to cost $1,000.

Toronto, Ont.—The public school which will be erected on Sydenham street, will cost about $182,000. Tenders have been opened.

Toronto, Ont.—The Pharmacal Co., has applied to the city architect for a permit to build an addition to their factory on Brockton Ave., to cost $7,000.

Montreal, Que.—The Marcil Trust Co. purpose erecting an office building on St. James street. Edward & W. S. Maxwell, of this city, are the architects.

Orillia, Ont.—The town council have accepted the plans for the proposed municipal buildings, prepared by Burke, Horwood & White, architects of Toronto. The cost is estimated at $70,000.

Quebec, Que.—A building permit has been issued to the Public Service Corporation for an extension to the power house to cost $1,800, and the construction of a warehouse to cost $2,500.

Toronto, Ont.—Work will begin shortly on the Imperial Oil Co.'s new building at the corner of Court and Church streets. The structure will be 115 ft x 76 ft., and ten stories high. It will be of steel construction with limestone exterior.

Wood-Working

Bury, Que.—L. H. Martin will build a sawmill to cost about $10,000.

Vancouver, B.C.—A. B. Cahoon, Cedar Rapids, Mich., is contemplating building a furniture factory here.

Montreal, Que.—Fire destroyed the carriage factory owned by S. H. Chapleau, on Oct. 18, doing several thousand dollars damage.

Baie Verte, N.B.—Fire on Oct. 5 destroyed Capt. E. R. Woods' cooperage. The damage is estimated at $1,500, inclusive of machinery.

PROFESSIONAL DIRECTORY

If what you want is not advertised in this issue consult the Buyers' Directory at the back.

Marine

Ottawa, Ont.—Engineers who have been at work on the Toronto harbor situation have completed their report for submission to the Minister of Public Works. The work will be made good and construction will be proceeded with without delay.

Montreal, Que.—The Dominion Coal Co. has abandoned hope for the safety of its colliers, Kron Prinz Olav and Easington, which left Sydney, N.S., on Sept. 25, the former for Montreal and the latter for St. John, N.B. The two ships ran into a hurricane on Sept. 26. The Kron Prinz Olav had a crew of 23 men and the Easington carried 20 men.

Canada Steamship Lines.—J. W. Norcross, vice-president and managing director Canada Steamship Lines, states that the record rates for transport of grain on the Great Lakes and Transatlantic will have a favorable influence on the result of the company's earnings this year. Arrangements have been made, Mr. Norcross said, for the chartering of seventeen of the company's steamers for the entire winter, but would not state what rates had been secured except to say that the charters were favorable .

The Newfoundland Naval Reserve.—The total registration for the Newfoundland Royal Naval Reserve to date is 1,200. Of these, 63 have laid down their lives for the Empire in active service, while others have died through natural causes and more invalided home. The total loss since the war began is approximately 100, so that the present fighting strength of the unit can be estimated at 1,100 men. Of these, 75 are in training on H.M.S. "Calypso" at St. John's, and the remainder on active service in the North Sea doing their duty by King and country.

Trinity, Newfoundland.—It is proposed to make this the winter shipping port of the Anglo-Newfoundland Development Co., whose pulp and paper-making works are situated at Grand Falls. It is highly probable that will be carried to a successful termination, as the commercial people and others of the district have petitioned the Government to have the stub railway leading into the town completed and suitable piers erected. It will mean much, financially and otherwise, to all parties concerned. Mr. Scott, the company's manager, approves of the scheme, viewing it as he does that during the past few years their shipping port in Notre Dame Bay has during winter time been practically closed, inconveniencing as a result their shipment of products. Trinity is an ice free port all year round, besides a town of

considerable commercial standing in the district, of which it is the capital.

New Incorporations

The Dominion Brake Shoe Co., has obtained a Provincial license at Toronto to carry on business at St. Thomas, Ont., with a capital not to exceed $200,000.

The Circle Bar Knitting Co. has been incorporated at Ottawa with a capital of $100,000 to carry on a general knitting mill business at Kincardine, Ont. Incorporators: William Mitchell, James Malcolm and Walter G. Keebler, all of Kincardine, Ont.

The Morse Porcupine Syndicate has been incorporated at Toronto, Ont., with a capital of $35,000 to acquire and develop mines, mineral lands and deposits. Head office at Toronto: Incorporators: Elmer McLeod Rowand and Oscar Heuman King, of Toronto.

The Standard Steel Co., has been incorporated at Ottawa, with a capital of $200,000, to manufacture corrugated steel pipes, culverts, etc., at Montreal, Que. Incorporators: Louis Athanse David, Louis D'Argy Mailhiot and H. R. Bush, all of Montreal.

The Canadian Chadwick Metal Co. has been incorporated at Toronto with a capital of $40,000, to carry on the business of brass founders, iron founders, mechanical engineers, at Dundas, Ont. Incorporators, Arthur Burgess Turner and George Alexander Young, of Hamilton, Ont.

The Neely Rotary Engine Co. of Canada has been incorporated at Ottawa with a capital of $200,000 to manufacture engines, automobiles, trucks, machine tools, etc., at Toronto, Ont. Incorporators: Wilbut Fletcher Neely, John Whitfield and Arthur T. Lawson, all of Toronto.

The Laurentide Power Co. has been incorporated at Ottawa with a capital of $10,500,000 to carry on the business of an electric light, heat and power company. Head office at Montreal. Incorporators: Warwick Fielding Chipman, Walter Robert Shanks and F. G. Bush, all of Montreal.

St. Catharines Steel & Metal Co., has been incorporated at Toronto, Ont., with a capital of $50,000 to carry on the business of manufacturers of machinery, tools, ammunition of all kinds at St. Catharines, Ont. Incorporators: Harry Shortt and Henry H. Collier of St. Catharines, Ont.

The O'Brien Munitions, has been incorporated at Ottawa with a capital of $2,000,000 to carry on the business of mechanical, electrical and chemical en-

gineers, and to manufacture munitions of war at Renfrew, Ont. Incorporators: Robert George Code, Edmund Foster Burritt and Erwin C. Pixley, all of Ottawa, Ont.

The Specialty Machine Co. has been incorporated at Toronto, Ont., with a capital of $150,000 to carry on the business of iron founders, mechanical engineers and manufacturers of munitions, specialties, tools, etc., at Toroto. Incorporators: George McClure Willoughby, James Henry Fraser and Francis H. Hurley, all of Toronto.

Catalogues

Temperature Booster.—The W. E. Clark Co., Toronto, have issued a folder describing the Clark temperature booster. This is a device for increasing the circulation of the water in hot water heating systems. A full description covering the construction and method of operation is given, accompanied by sectional views.

The Cowan Trucking System is the title of a catalogue issued by the Cowan Truck Co., Holyoke, Mass. This catalogue contains principally a number of testimonials with full-page half-tones showing the Cowan truck being used in a number of plants and for a variety of purposes. The concluding pages contain illustrations of the various types of this truck or transveyor, together with dimensions and descriptions, and also a list of replacement parts.

The Union Twist Drill Co., Athol, Mass., have published a "Book of Information" catalogue G, dealing with an extensive line of twist drills, reamers, gear and milling cutters, and machine tools which the company manufacture. The catalogue is divided into six sections each being devoted to a different product; there being also a separate index for each section. All the tools listed are illustrated and are accompanied by a brief description and dimensions. No. 1 or cutter section contains a lot of valuable information on gear cutters with formulae for determining the dimensions of gears by diametral pitch, cutting mitre and bevel gears, calculating diameters of sprocket wheels for block centre chains and cutting involute teeth, etc. The formulae are accompanied by diagrams of gear sections. The sixth and last section, in addition to matter relating to arbors, contains several useful mechanical tables on cutting speeds, decimal equivalents, tap drills, screw threads, etc. The catalogue is pocket size and contains 380 pages. It is a useful publication to have on file for reference.

Book Reviews

Products and By-products of Coal.—The Department of Mines, Ottawa, has issued Bulletin No. 323, dealing with products and by-products of coal. The object of this report is to satisfy, as far as possible, the increasing need for a monograph on fuel products and by-products. The subject, however, is so comprehensive that it is impossible—within the limits of a bulletin—to treat it other than in outline.

The subject matter of the present report is divided into two parts—(1) the production of coke, gas, ammonia, and tar from bituminous coal; (2) the properties and uses of these products and by-products. In setting forth the results of these investigations, the aim has been to give prominence to the commercial rather than to the scientific aspect of the subjects treated, especially as regards their bearing on existing conditions in Canada.

The present time is particularly opportune for discussing the question of establishing new lines of trade and commerce, for, on account of the deplorable war conditions in Europe, all industries are more or less dislocated as regards supply and demand, and manufacturers everywhere are taking stock of current conditions and future possibilities. The trade possibility, that would naturally occur to most people interested in the commercial development of Canada, is the establishment of a coal-tar dye industry; since here, as in other countries, factories using dyes are being seriously inconvenienced, owing to the fact that Germany—by a combination of scientific research, technical ability, and commercial energy—has for years had practically a monopoly in the manufacture and supply of coal-tar dyes; and consequently since the opening of the war importation of this commodity from Europe has almost ceased. Conditions, however, show that the importation of dyes into Canada is not large, and that the prospect of developing a flourishing coal-tar dye industry is not encouraging.

Nevertheless, there are other important by-products from coal which, although not figuring so prominently in the public eye, are of much greater importance commercially, and are also peculiarly suited for production in Canada.

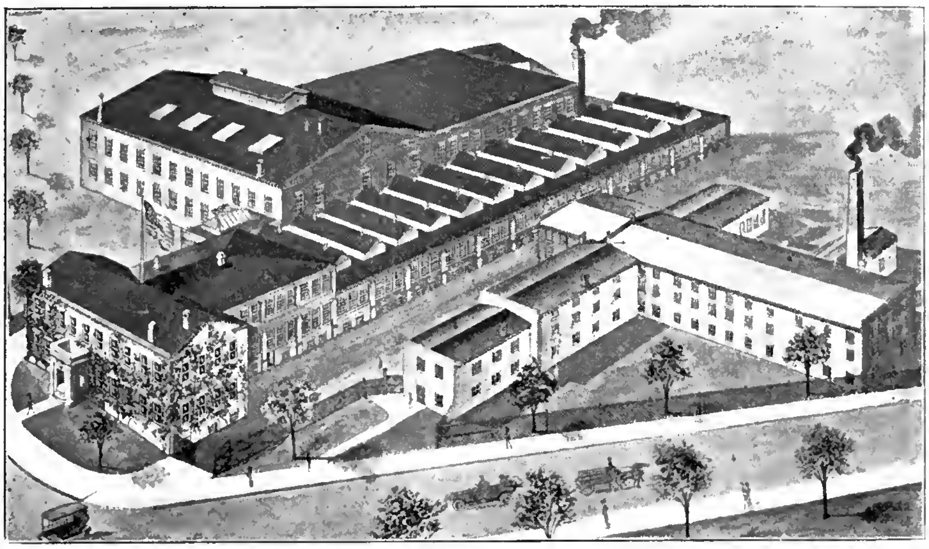
Processes, plants, and methods are comprehensively described, such subjects as coke ovens, etc., with the resulting products, coke, gas, ammonia, and tar, being considered.

Concise information is given regarding the commercial products of coal tar, the first products from this substance and their field of industrial application being

of particular interest at the present moment.

Experience in Efficiency, by Benj. A. Franklin, 167 pages, 7½ in. x 5 in., published by the Engineering Magazine Co., New York. Price $1.00. This book is an addition to the Works Management Library, most of the chapters appearing originally in the Engineering Magazine. The book has been written as a reply to requests often made for specific examples of efficiency methods. The author takes as a basis the conditions prevailing in a certain factory, and after a close study of the situation proceeds to explain what was right or wrong and if the latter how it was corrected. He also explains how greater shop economies were effected and larger profits made without any change of organization or personnel. The book contains ten chapters. The first four are devoted to a description of methods for increasing both the output and quality of direct production, which is largely connected with the handling of labor. The fifth chapter extends the same principles to the treatment of clerical or as it is usually termed non-productive labor. The sixth chapter covers similar ground with the same applied ideas only on a larger scale so as to include the entire force. Organization rather than individuals is the theme of the next chapter while chapter eight deals with the reduction of factory expenses. An efficient cost system is outlined and developed in chapter nine while the concluding chapter dwells on the necessity of efficiency will. In this chapter it will be found that all the preceding measures are connected to and based upon the fundamental necessity of "efficiency will" as a driving force in the establishing of efficiency practice. The subject has been treated in a logical manner and shows clearly the character of the problem attacked and the nature of the solution found.

Knock at our Door with an Inquiry or an Order, and you will find yourself Well Served



Geometric Tools are furnished in many sizes and types for all classes of internal and external thread-cutting, and to suit all makes of Screw Machines.

We make nothing but Thread-Cutting Tools, and thus maintain in them our standard:—"Finest Quality, Greatest Quantity, at Least Outlay."

THE GEOMETRIC TOOL COMPANY **NEW HAVEN, CONN., U.S.A.**

Canadian Agents: Williams & Wilson, Ltd., Montreal. The A. R. Williams Machinery Co., Ltd., Toronto, Winnipeg and St. John, N.B.

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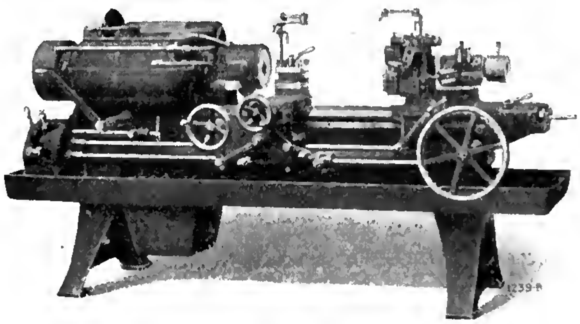
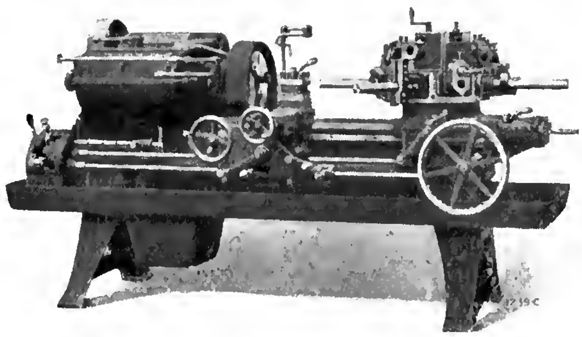


No. 2-A—With "Bar Equipment"

Separate feed shafts, each with ten individual feeds, operate the carriage and turret saddle independently, and provide the exact feed required for each.

And to this great advantage are added the other essentials for rapid and accurate production—excess power, extreme rigidity, great adaptability, and a power rapid traverse that saves time and conserves the energy of the operator.

Without obligation, ask us to show the saving on one of your typical jobs. Send blueprints with rough and finished samples.



No. 2-A—With "Chucking Equipment"

THE WARNER & SWASEY CO., Cleveland, Ohio, U. S. A.

Canadian Agents: A. R. Williams Machinery Company, St. John, Toronto, Winnipeg, Vancouver; Williams & Wilson, Montreal.

Tillsonburg, Ont.—A large auto firm of Detroit is negotiating with the directors of the Tillsonburg Electric Car Co., regarding securing its building for the purpose of manufacturing auto bodies.

Tenders

Toronto, Ont.—Tenders for lead covered cable, addressed to the chairman of the Toronto Electric Commissioners, will be received until Tuesday, November 16, 1915. Specifications and form of tender can be obtained at the office of the purchasing agent, 15 Wilton Avenue.

Toronto, Ont.—Tenders will be received, addressed to the Chairman, Board of Control, City Hall, up to Tuesday, November 9, 1915, for the supply of a radial drill for machine shop, Danforth Avenue car barns. Specifications and forms of tender may be obtained at the Works Department, Room 12, City Hall.

Toronto, Ont.—Tenders for all trades required in connection with the erection of an incinerator building, bridges, etc., on the Don Roadway, will be received up to Tuesday, November 9. Plans and specifications may be seen and forms of tender and all information obtained at the office of the city architect, City Hall, Toronto.

Toronto, Ont.—Tenders will be received, addressed to the Chairman, Board of Control, City Hall, Toronto, up to Tuesday, November 9, 1915, for the supply and erection of valves, steam piping, special steel castings and lagging, for main pumping station. Specifications and forms of tender may be obtained at the Works Department, Room 12, City Hall.

Ottawa, Ont.—Tenders will be received until Wednesday, November 10, 1915, for the construction of steel gates, towers and operating machinery for the regulating dam, Big Chaudiere Falls, French River, Ont. Plans and form of contract can be seen and specification and forms of tender obtained at the Department of Public Works, Ottawa, and at the offices of the District Engineers, Confederation Life Building, Toronto, and Shaughnessy Building, Montreal.

Ottawa, Ont.—Tenders will be received up to Tuesday, November the 23rd, for the undermentioned items for delivery to H.M.C. Dockyards at Halifax, N.S., and Esquimalt, B.C.: Steel and iron bolts, nuts and rivets, electric cable and wire, mineral grease, castile soap, hard soap, turpentine, chemicals, cleansing powder, bunting. Forms of tender and all information may be obtained by application to the Naval Store officer at H.M.C. Dockyards at Halifax, N.S., or Esquimalt, B.C., or to G. J. Desbarats, Deputy Minister of the Naval Service, Ottawa.

Contracts Awarded

Sherbrooke, Que.—The city council have awarded a contract for cast iron pipe to Codere & Sons Co.

Windsor, Ont.—The contract to install a new Scotch boiler in the waterworks has been awarded the International Engine Works, Montreal. The boiler, including installation, will cost about $5,000.

Toronto, Ont.—The Board of Control has awarded the contract to the Northern Crane Works, Ltd., for the supply and erection of an electric crane, hoist and single line clam shell bucket at the main sewage disposal works, for $3,580.

Personal

H. V. Armstrong, B.A.Sc., for several years town engineer of Estevan, Sask., has resigned.

H. Sydney Hancock, Junr., formerly city engineer of Fort William, Ont., has left for England.

H. T. Jackson, of Montreal, has been appointed to the position of manager of the Record Foundry & Machine Co., Moncton, N.B.

Lieut. Herrick Duggan of the Royal Engineers, and until recently on the staff of the Dominion Bridge Co., Lachine, Que., has been wounded in France.

David A. Thomas, representative of the British Minister of Munitions, has left Ottawa for New York on his way back to England. His work is now in the hands of Lionel Hichens.

A. W. Smithers, chairman of the Board of Directors of the Grand Trunk Railway System, has arrived in Montreal from London, England, to consult with President E. J. Chamberlin. Mr. Smithers will not make his customary visit to the Coast.

P. Gifkins, general manager of the Dominion Atlantic Railway for the past fifteen years, and associated with the company for forty-four years, has retired. George E. Graham is the new general manager, with headquarters at Kentville, N. S. The change takes effect on November 1.

Geo. E. Graham, formerly superintendent of the British Columbia division of the C.P.R., and for the past two years general manager of the Coquitlam Terminal Co., has been appointed general manager of the Dominion Atlantic Railway, a subsidiary line of the C.P.R., operating in the Maritime Provinces.

Capt. Leon H. Curry of the 42nd Royal Highlanders, of Montreal, was killed in action recently in Northern France. Capt. Curry was born at Amherst, N.S., 30 years ago. About three years ago he was appointed assistant to the vice-president and general manager of the Canadian Steel Foundries, Montreal, Que.

Sir Charles Tupper, Bart., K.C.M.G., died in London, England, on Oct. 30, at the age of 94. Sir Charles was born at Amherst, N.S., on July 2, 1821, and in 1855 entered upon his public career. He was appointed Minister of Public Works in 1878, in the MacDonald Administration and afterwards he created the Department of Railways and Canals, and was its first Minister. It was while Minister of Railways and Canals that he carried out important works in connection with the enlargement of the Welland Canal, the deepening of the St. Lawrence, and the construction by private company of the Canadian Pacific Railway. Sir Charles Tupper was created a K.C.M.G. in 1879, a G. C.M.G. in 1886, a Baronet of the United Kingdom in 1888, and an Imperial Privy Councillor in 1908.

Sir Andrew Noble, Bart., K.C.B., the famous authority on artillery and explosives, and chairman of the Armstrong, Whitworth & Co., Newcastle-on-Tyne, England, died recently. Sir Andrew was born at Greenock, Scotland, in 1831. In 1860 he began his famous partnership with Lord Armstrong who had established a plant for making ordnance at Elswick. Later on the firm amalgamated with the Whitworth Co., the new concern being known as Armstrong, Whitworth & Co., which has developed into one of the greatest industrial establishments in the world. Sir Andrew received many honors. He was created a C. B. in 1881, and K. C. B. in 1893, and a Baronet of the United Kingdom in 1902. In 1870 he was elected a Fellow of the Royal Society; and in 1880 received the Royal Medal of that Society. He was a Knight of various foreign orders, and was honored by many learned and scientific bodies.

Trade Gossip

The Algoma Steel Co., of Sault Ste. Marie, Ont., has contracted to supply 30,000 tons of steel rounds to Great Britain. The company is also said to have closed orders for 20,000 additional rounds.

The Windsor Brass Foundry Co., Windsor, Ont., have purchased the Cana-

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¶ If you want to sell or buy a second-hand lathe, planer or any other shop equipment, let "CANADIAN MACHINERY" pick out a seller or buyer for you. How about that second-hand engine or boiler which you would like to dispose of?

Rates (payable in advance):—2c per word first insertion, 1c per word subsequent insertion. 5c additional each insertion when Box Number is required. Each figure counts as one word.

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FOR SALE — NEW HAVEN SIXTY INCH face plate Lathe—fifteen foot bed, complete with countershaft, steady rest, etc. Excellent tool for boring and nosing shells. Cost thirty-five hundred—will take two thousand. Bancroft Lathe, ten inch swing, 5 ft. bed, screw cutting, good condition, $125. Winnipeg Machinery Exchange, Winnipeg. (21)

FOR SALE

FOR SALE—GAS ENGINE, 22 H.P., WITH Magneto, Battery, Water Tank, Gasometer, Muffler and 26" Clutch Pulley, cheap. This engine was used four months during the erection of our plant. The same is equipped for natural gas, but can be changed and used with gasoline at very reasonable expense. Well-known United States engine. Original cost, $600.00, besides the duty. Address H. Mueller Mfg. Co., Ltd., Sarnia, Ont. (21)

FOR SALE—ELECTRIC PASSENGER AND freight elevator plant. Patterns—Drawings—Blueprints—special and ordinary machinery and stock. This is a splendid business—few competitors. We offer a decided bargain. Winnipeg Machinery Exchange, Winnipeg. (21)

Advertising

"Advertising is the education of the public as to who you are, where you are, and what you have to offer in the way of skill, talent or commodity. The only man who should not advertise is the man who has nothing to offer the world in the way of commodity or service."—*Elbert Hubbard.*

dian manufacturing rights of the Harvey valve. The company are also putting on the market the "Bradley" auto sleeper.

Arnold Thompson, chief inspector and late foreman toolmaker with the Canadian Allis-Chalmers, Toronto, has resigned his position and will take over the Tobin Arms Factory at Woodstock, Ont. The firm will be known as the Arnold Thompson Tool Co., and the product will be jigs, tools and gauges, etc.

Montreal, Que.—A new subsidiary of the Dominion Bridge Co., of Lachine, Que., has just been incorporated at Ottawa, its purpose being to take up the manufacturing of brass discs for cartridge cases and copper bands for shells, an entirely new enterprise in Canada. The promoters of the new concern are G. H. Duggan and H. H. Vaughan, of the Montreal Ammunition Co. The Company is capitalized at $300,000 and the factory will be at Montreal.

Industrial Conditions Much Better.—A most gratifying report has been prepared by W. D. Lighthall, secretary of the Union of Canadian Municipalities. It was to the effect that after a thorough investigation into unemployment problems in all parts of the country, it would be unnecessary to call a Dominion-wide convention to discuss what could be done to help conditions. Most of the places, Mr. Lightall says, will be quite able to look after their own unemployed this year.

McLaughlin Carriage Co.—The deal between the Carriage Factories, Ltd., and the McLaughlin Carriage Co., of Oshawa, whereby the former concern takes over the entire carriage end of the McLaughlins has been closed. The McLaughlins will give their entire attention to the automobile trade. It is said that Carriage Factories, which is a Brockville concern, has secured the business on exceptionally favorable terms. The McLaughlin Company has secured the Canadian agency of the Chevrolet motor car, and this enlarged business will demand the company's energies formerly given to carriage manufacture.

New Incorporations

The Casey-Harris Mining Co., has been incorporated with a capital of $100,000, to acquire and develop mineral lands and deposits. Head office at Toronto.

The Diaphone Signal Company, has been incorporated at Ottawa with a capital of $825,000, to manufacture all kinds of signalling devices, at Toronto. Incorporators: Gideon Grant and Bruce Williams, both of Toronto.

STRIP STEEL

PLAIN steel sheets, black "Premier" Galvanized Sheets, Open-Hearth Drawing stock.

We can furnish these promptly and at lowest prices.

We carry an immense stock from ten to thirty gauge.

Get our prices.

Dominion Sheet Metal Co., Limited
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52-S

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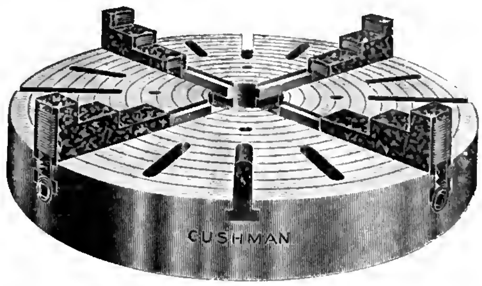

When you buy a "Cushman" Chuck you are absolutely sure of getting one having strength, accuracy and durability. Being specialists in these goods we are able to furnish Chucks of quality at a very moderate price.

Our line of styles and sizes is very complete—

Lathe Chucks, Drill Chucks, Centering Chucks, Portable Face Plate Jaws

Our regular chucks are known as the heavy pattern, but we now have a new line called "Blue Line" Chucks, made entirely of steel.

Let us send you our catalog.

The Cushman Chuck Co.
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THE Carbic Regd LIGHT
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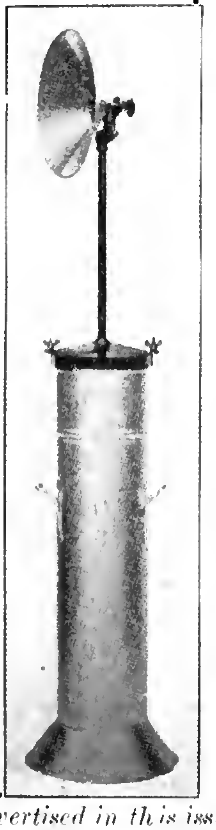
THE CARBIC FLARE LIGHT 2,000 C.P.



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Indispensable for Construction Work, Railroad Auxiliaries, Foundries, Mines, etc.

Absolutely Non-Explosive. Easy to Operate. Nothing to Get Out of Order. Can be Re-charged in a Minute.

Made in two sizes:
No. 1, Burns 6 hours.
No. 2, Burns 12 hours.
Takes No. 20 Carbic Cake.

Absolutely the most economical lamp on the market to-day.

W. L. FOSTER
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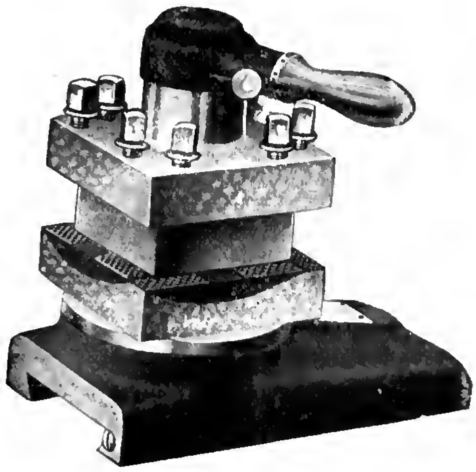
Making SHRAPNEL ?

Here is Standard Equipment

The Fay & Scott turret tool post shown here is being universally adopted as standard equipment for the manufacture of shrapnel.

The square head turret, style G, is used for turning the outside of the shell. We have made these turrets for years, and can fit them to any make or size of lathe, old or new.



Style G

Catalog and full details on request

Fay & Scott, Dexter, Me.

Renown Engine & Machine Co., has been incorporated at Ottawa with a capital of $50,000, to manufacture machinery of all kinds and war munitions, at Montreal. Incorporators: Alexander Ronald Johnson and Arthur Ross, of Montreal.

The Canadian Gahagan Construction Co., has been incorporated at Ottawa with a capital of $100,000 to carry on the business of general contractors, engineers, at Toronto. Incorporators: John Shirley Denison and Frank James Foley, of Toronto.

The Lachance Nut Lock Co., has been incorporated at Ottawa with a capital of $300,000, to manufacture the "Lachance" nut lock and other devices, at Montreal, Que. Incorporators: Joseph Alphones Bilodeau and Maurice Loranger, of Montreal.

The National Steel Products, has been incorporated at Ottawa with a capital of $100,000, to manufacture munitions, explosives, projectiles, shells, aeroplanes, guns and gun carriages, at Toronto, Ont. Incorporators: Thomas Gibson and Joseph Garfield Gibson, of Toronto.

The Eastern Machinery Co., of Montreal, has been incorporated at Ottawa with a capital of $45,000 to carry on the business of machinists, mechanical, electrical and civil engineers, at Montreal. Incorporators: Armand Lalonde and Emile Alphonse Lalonde, both of Montreal.

Steel and Radiation, Ltd., has been incorporated at Ottawa with a capital of $5,000,000, to manufacture iron, steel and other metals and to carry on the business of an engineering and construction company, at Toronto. Incorporators: James Steller Lovell, Robert Gowans and John Joseph Dashwood.

Catalogues

Safety Valves—The James Morrison Brass Mfg. Co., Toronto, have issued a bulletin illustrating and describing their line of safety valves for high and low pressures and super-heat steam. A price list is included for the various types.

Murphy, Stearman & Co., 180 Gray's Inn Road, London, England, have sent us a copy of their new catalogue. The goods dealt with are all British made and embrace complete equipment for foundries and machine shops, and many other lines for engineers and contractors.

The Canadian Allis-Chalmers, Ltd., Toronto, have issued a bulletin No. 1633 which describes a test of a low head hydraulic power plant at the Grand Rapids, Wis., station of the Centralia Pulp &

Water Co. The test gives some interesting data on hydro-electric plant operation, including a series of velocity curves.

Reducing Valves, made by the James Morrison Brass Mfg. Co., Toronto, Ont., are described fully in a folder recently issued. A sectional view is shown of the J. M. T. reducing valve, which is followed by a description covering the method of operation, and also directions for installing and cleaning. A price list is included, giving weights and dimensions of the various sizes.

Foundry Equipment.—The National Engineering Co. of Chicago, Ill., have issued a bulletin dealing with the "Simpson" intensive foundry mixer and "Simpson" national screen separator. The construction of the mixer and methods of handling various materials are fully described, while illustrations give a general idea of the machine. The screen separator is also described and illustrated.

"The Cost of Pumping Water" is the title of a collection of graphical charts with accompanying explanatory text issued by the DeLaval Steam Turbine Co., of Trenton, N.J. The object of the publication is to facilitate computation of the overall economy of different types of steam pumping units, having given the cost of fuel, steam pressure, rate of interest, cost of apparatus and other variables. The first chart shows the number of B.t.u., represented by each pound of steam for various combinations of superheat, steam pressure and feed water temperature. The second chart gives the cost of 1,000 lbs. of steam and the cost of a million B.t.u.'s in the steam from the cost of coal per ton, the heat value of the coal and the boiler efficiency. The third diagram shows the relation existing between the average cost of steam-turbine-driven centrifugal pumping units and the head pumped against. The fourth diagram shows the amount of money to be set aside yearly for sinking fund, to cover depreciation for different terms of life and rates of interest. The fifth diagram is the well known Mollier steam chart, supplemented by a convenient scale by means of which B.t.u. available per pound between given limits, the resulting velocity of steam in feet per second and the corresponding duty in foot pounds per 1,000 lbs. of steam, and the pounds of steam per h.p. hour may be read off directly. The sixth diagram is an alignment chart for determining the resistance of pipes to flow of water. Three scales represent gallons per minute, diameter of pipe in inches, and loss of head in feet per 1,000 ft. of pipe. A straight edge laid across points corresponding to known figures on two of the scales, shows the third variable by intersection with the remaining scale. At the end of the publication a list of representative municipal installations of De Laval steam-turbine-driven centrifugal pumps, from which it is to be observed that units of this type have been installed for capacities as large as 100,000,000 gallons per day and heads as great as 334 ft., and have developed duties exceeding 150,000,000 ft., lbs. per 1,000 lbs. of steam. It is also pointed out that because of the low first cost of apparatus, foundations and buildings inherent in this type of pump, the total cost of pumping water is greatly reduced as compared with the much larger, heavier and more expensive triple-expansion reciprocating pumping engines, in spite of the somewhat higher duty exhibited by the latter. Copies of the publication are offered gratis to those interested.

Book Reviews

The Influence of Temperature Upon the Strength of Concrete, by A. B. McDaniel, has been issued as Bulletin No. 81 of the Engineering Experiment Station of the University of Illinois. This bulletin presents a study of the data obtained from three series of tests of concrete cubes and cylinders. These specimens were stored under temperature conditions varying from 25 deg. to 90 deg. F., and were tested at various ages up to twenty-eight days. Curves are presented to show the relation between strength and age for different temperature conditions, and also the relation between strength and temperature at different ages. The results are summarized in a set of curves which show the percentage strength of concrete at different ages and under different temperature conditions to that at an age of twenty-eight days and under a normal temperature of 70 deg. F. The results of the tests made under freezing temperature conditions are of especial interest; showing the gradual and slow gain in strength under a storage temperature slightly below freezing, and the disintegrating effect of alternate thawing and freezing temperatures. The bulletin will be of value to the contractor, engineer and others engaged or interested in construction work for information regarding the strength which may be expected of ordinary concrete under different age and temperature conditions and the time for the removal of the forms. Copies of Bulletin No. 81 may be obtained gratis upon application to W. F. M. Goss, Director of the Engineering Experiment Station, University of Illinois, Urbana, Ill.

Personal

City Engineer Mellis Ferguson, of St. Thomas, Ont., has applied to the Board of Water Commissioners for leave of absence in order that he may attend the school of military instruction at London, Ont.

W. J. Shaughnessy has been appointed a director of Canada Foundries and Forgings, Ltd., to fill the vacancy caused by the death of Robert Bowie, Brockville. Not long since Mr. Shaughnessy was appointed to the board of the West Kootenay Power and Light Company. He is one of the well-known of the younger members of the Montreal Bar and a son of Sir Thomas Shaughnessy.

Sir Frederick Donaldson, head of the Woolwich Arsenal, who came to Canada last month with Lionel Hichens to inquire into the possibilities of ordnance manufacturing in Canada, has left for England. He will report to the War Office as to the conditions in Canada and the feasibility of establishing ordnance works in Canada which might be in a position to turn out big guns in time for use during the present war. It is understood that several of the big Canadian iron and steel firms are willing to go into the business, providing that sufficient orders are guaranteed to warrant the outlay for new machinery, and providing also that skilled workmen can be secured.

Trade Gossip

The Roelofson Elevator Co., Galt, Ont., have been awarded the contract for an elevator for the Susman & Cohen Co.'s new factory at Kingston, Ont.

The Collingwood Shipbuilding Co., Collingwood, Ont., has been awarded a contract for a large steel freighter, similar in size to the J. G. Hagarty.

The Consolidated Mining & Smelting Co., Trail, B.C., have awarded a contract for the supply of several electric travelling cranes to the Northern Crane Works, Walkerville, Ont.

The Villeneuve Machine Gun Co., a corporate firm, with a capital of $99,000, has just been granted its letters patent for the manufacture and production of machine guns, cannon and firearms of all denominations. The company was incorporated at Quebec.

The Orillia Molybdenum Co., Orillia, Ont., has made its first shipment of two tons of concentrates of Molybdenite to the British War Office. This is the first time that this ore has been treated in Canada. The company has received instructions from the War Office to make weekly shipments for an indefinite period.

Heavy Guns Likely to Be Made Here.—According to an Ottawa despatch, Montreal may shortly have an extensive industry in the manufacture of heavy guns and ordnance. J. H. Whitfield and M. J. Butler, of the Armstrong-Whitworth Corporation, whose extensive works are located on the South Shore, are now in Ottawa, and it is understood that the company is prepared to go into the manufacture of heavy guns and ordnance if orders are forthcoming.

Quebec Bridge Progressing.—The last connecting link in the north cantilever arm of the new Quebec Bridge was driven on Nov. 4, and the arm is now completed; in fact, the whole north side of the bridge is completed with the exception of a few bolts. The anchor arm of the south shore will be completed next week. The cantilever arm of the south shore will be completed next spring or summer, and the centre and final span will then be towed up and placed in position by next fall, it is anticipated, so that trains may be crossing the bridge before next winter.

CLASSIFIED ADVERTISEMENTS

¶ If you want to sell or buy a second-hand lathe, planer or any other shop equipment, let "CANADIAN MACHINERY" pick out a seller or buyer for you. How about that second-hand engine or boiler which you would like to dispose of?

Rates (payable in advance):—2c per word first insertion, 1c per word subsequent insertion. 5c additional each insertion when Box Number is required. Each figure counts as one word.

FOR SALE

FOR SALE — NEW HAVEN SIXTY INCH face plate Lathe—fifteen foot bed, complete with countershaft, steady rest, etc. Excellent tool for boring and nosing shells. Cost thirty-five hundred—will take two thousand. Bancroft Lathe, ten inch swing, 5 ft. bed, screw cutting, good condition, $125. Winnipeg Machinery Exchange, Winnipeg. (21)

FOR SALE

FOR SALE—GAS ENGINE, 22 H.P., WITH Magneto, Battery, Water Tank, Gasometer, Muffler and 26" Clutch Pulley, cheap. This engine was used four months during the erection of our plant. The same is equipped for natural gas, but can be changed and used with gasoline at very reasonable expense. Well-known United States engine. Original cost, $600.00, besides the duty. Address H. Mueller Mfg. Co., Ltd., Sarnia, Ont. (21)

FOR SALE—ELECTRIC PASSENGER AND freight elevator plant. Patterns—Drawings—Blueprints—special and ordinary machinery and stock. This is a splendid business—few competitors. We offer a decided bargain. Winnipeg Machinery Exchange, Winnipeg. (21)

FOR SALE—RICHARDS INDICATOR, COMplete, with attachments, nearly new, in perfect order. Apply Canadian Machinery, 143 University Ave., Toronto.

Tenders

Toronto, Ont.—Tenders for lead covered cable, addressed to the chairman of the Toronto Electric Commissioners, will be received until Tuesday, November 16, 1915. Specifications and form of tender can be obtained at the office of the purchasing agent, 15 Wilton Avenue.

Toronto, Ont.—The Toronto Electric Commissioners will be glad to receive tenders for overhead line construction work. Particulars may be obtained on application to the Purchasing or Engineering Departments, 15 Wilton Ave.

Ottawa, Ont.—Tenders will be received up to Tuesday, November the 23rd, for the undermentioned items for delivery to H.M.C. Dockyards at Halifax, N.S., and Esquimalt, B.C.: Steel and iron bolts, nuts and rivets, electric cable and wire, mineral grease, castile soap, hard soap, turpentine, chemicals, cleansing powder, bunting. Forms of tender and all information may be obtained by application to the Naval Store officer at H.M.C. Dockyards at Halifax, N.S., or Esquimalt, B.C., or to G. J. Desbarats, Deputy Minister of the Naval Service, Ottawa.

Municipal

Mimico, Ont.—A site comprising 7 acres has been purchased for the proposed sewage disposal plant.

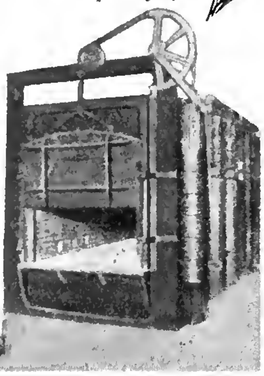
Niagara Falls, Ont.—A test by-law on the question of establishing a municipal bakery was lost by a vote of two to one, on Nov. 3.

Toronto, Ont.—Plans have been approved by the Board of Control for the proposed incinerator building on the river Don. The structure will cost $150,000.

Tilbury, Ont.—The request of the Brantford Gas Co. to be allowed to lay three gas mains to supply the manufacturers with Tilbury unpurified gas has been granted by the city council.

Edmonton, Alta.—An agreement has been drawn up between the city and the Edmonton Power Co. whereby the latter guarantee to spend $7,500,000 in five years in and about the city to carry out the terms of the contract.

Halifax, N.S.—The Board of Control have adopted the following report of Controller Harris, on the application of the Imperial Oil Co., for property at Africville, and recommend that the city council pass it. The company will probable spend $250,000 on buildings and plant.



TORONTO MARKETS

(Continued from page 459.)

for scrap copper, brass, zinc, and lead is reasonably active. The United States market is said to be over-supplied and a reaction may be expected. Quotations on the above-mentioned metals are unchanged with the exception of zinc, which has advanced, and is quoted at 10c per pound.

Metals

The general situation in the metal market is much the same as last week. The upward movement in tin continues and lead has also advanced slightly. There is no change in the copper market, but the position of this metal is a good one, and higher prices are more likely than otherwise. The spelter market is much firmer and indications point to higher prices in the near future. There is nothing of particular importance to note with regard to antimony and aluminum, except that supplies of the last-named metal are practically unobtainable. Solders are firmer and higher prices may develop shortly.

Tin.—Considerable activity has developed in the tin market and the upward movement continues. The market is in a sound position, but there is a possibility of a revival in speculation. Tin has advanced 1c and is quoted at 40c per pound.

Copper.—The market is steady and firm. Production is going on at a rapid rate, but at the same time consumption exceeds the output. The position of this metal is a strong one, as consumption will increase rather than decrease. Local quotations are firm at 19½c per pound.

Spelter.—The market is firm with a higher tendency. There is an improvement in demand in New York, both domestic and export. Spelter has advanced ½c, and is quoted locally at 18c per pound.

Lead.—The New York market is firm at the "Trust" price which is 5c per pound, while the London market has also advanced. The advance is attributed to increased demand. Lead has advanced ¼c and is now quoted at 6½c per pound.

Antimony.—The market is fairly active, but the general situation is unchanged. Antimony is quoted locally at 35c per pound.

Aluminum. — The situation is unchanged and supplies locally are almost unobtainable. Quotations are nominal at 60c per pound.

IT IS NOT the stockholders, the president or the claim agent who is getting hurt. It is the man on the job. For that reason, progressive companies are nowadays equipped with safety plans, safety devices and a safety organization.

If what you want is not advertised in this issue consult the Buyers' Directory at the back.

velopment of terminal facilities on the former Songhees Indian Reserve. It is hoped before the close of the year to have a section of the West Coast line completed as far as the first point reached at tidewater.

St. Marys, Ont.—An important hydro-radial railway meeting was held here on November 11. Mr. Lyon, chairman of the Ontario Hydro-Radial Union, presided. Secretary T. I. Hannigan was also present along with Engineer Gaby, chief engineer of the Ontario Hydro-Electric Commission, and about 35 representatives of the following municipalities: London, Lucan, Exeter, Biddulph, Blanshard and St. Marys. Resolutions were passed approving of the map plans as presented.

Toronto, Ont.—Plans for the second link in the Hydro-Electric Radial System that is to link up Toronto with Sarnia and take in all the municipalities along the line from Toronto, by way of Guelph and London, received emphatic approval on October 28 when the representatives of the eighteen municipalities interested in the section from Guelph to London met to consider the proposals of Sir Adam Beck and his colleagues of the Hydro-Electric Commission. By-laws will be prepared in the various municipalities and submitted to the ratepayers at the next municipal elections.

Trade Gossip

New Liskeard, Ont.—The Wabi Iron Works have recently installed an electric furnace.

The Linde Canadian Refrigeration Co. will install an ammonia rectifier and oil trap at the Municipal Abattoir, Toronto.

The National Steel Car Co., Hamilton, Ont., will manufacture motor-driven fire apparatus in addition to their present lines.

Gananoque, Ont.—The Ontario Steel Products Co. have received a large order for automobile springs and trench digging shovels.

Expansion of Hydro System.—Sir Adam Beck, Chairman of the Hydro-Electric Power Commission, had a meeting with the Ontario Cabinet recently and submitted further data with reference to increased power development at Niagara Falls.

The Standard Steel Co. has been organized in Montreal to manufacture steel products and shells. A building has been rented and will be equipped with the necessary machinery. The head office is in the Transportation Building, and the president is E. G. Jackson.

Petrolia, Ont.—The Western Sugar Refining Co., which proposes building a sugar beet refinery here, have appointed the following provisional directors: Ralph D. Mitchell and D. J. Kelly of Cleveland, O.; David A. Gordon of Wallaceburg, Ont.; K. C. Kerr and R. G. R. MacKenzie, of Petrolia.

Agricultural Machinery for France.—Two big trains made up of sixty carloads of agricultural machinery have been shipped by Massey-Harris Co., from Brantford, Ont., for use in France. War for some time cut off the export trade of the local branch of the firm, but lately it has picked up again.

The Nova Scotia Steel and Coal Co. has disposed of $1,500,000 of common stock and $1,000,000 of 6 per cent. debenture stock. The capital which has been obtained in this way will greatly strengthen the financial position of the company and enable it to comfortably take care of any additional business that is offering over and above the large amount which is now on hand.

The Canadian Briscoe Co. has been formed by Carriage Factories, Ltd., of Canada, as a subsidiary. The Canadian Briscoe Co. will assemble the parts in Canada from the Briscoe Motor Co., of Jackson, Mich., and the cars will be sold through Carriage Factories, Ltd., which has acquired the carriage manufacturing end of the McLaughlin Motor Co., Oshawa, Ont.

New Trade Commission.—The Minister of Trade and Commerce has appointed a new Trade Commission to the Far East. L. D. Wilgress, who for some time has been training in the department here, is going to Omsk, while C. W. Just will go to Petrograd. Mr. Just has conducted an extensive investigation into possibilities of trade with Russia and reports many promising openings.

Railway Earnings New High Record.—The gross earnings of the three Canadian railroads, the C. P. R., the G. T. R. and the C. N. R., for the month of October reached notable dimensions. For the fourth week they were $7,147,358, or an increase of $2,413,017, which is at the rate of 50.9 per cent. over the corresponding period a year ago. These are new high records for years. The combined gross earnings of the three roads for all October were $21,656,192, an increase of $4,942,000 over September, of $7,464,000 over August, of $8,500,000 over July, and of $8,790,000 over June. Compared with a year ago, the increase was $5,519,000, or 34.2 per cent., this being the first monthly increase since the war began, and comparing with a decrease of 3.7 per cent. in September.

The Canadian Steamship Lines, it is stated, have 107 boats in active service, 65 freight, of which 16 are on the ocean and 42 passenger. The ocean freighters, the same authority states, earn on the average $10,000 net per month, which for the winter months figures out at nearly $800,000. In addition to this, six vessels of the Quebec Steamship Company, a subsidiary, operate all year. The passenger revenue this year has not been as large as in 1914, but the above figures indicate that ocean traffic alone will wipe out last year's deficit. Freights from the head of the lake average about 4 cents this year against 1¾ in 1914. Operating costs have been cut down by means of various economies to the extent of about $400,000. These are the reasons why September and October earnings alone stood almost half a million dollars ahead of the corresponding months in 1914. It is well known that freight boats had very small storage cargoes at the head of the lakes last winter, but this year the capacity of the fleet of the company will be filled, to the extent of about 2,500,000 bushels, which, it is estimated, will net the company in the neighborhood of $200,000.

New Incorporations

The Ontario Aeroplane Co. has been incorporated at Toronto with a capital of $200,000 to manufacture aeroplanes, hydroplanes and water boats at Toronto. Incorporators: Jacob William Broudy and Thomas Hubert Wilson, of Toronto.

Gray-Dort Motors, Ltd., has been incorporated at Toronto, with a capital of $500,000 to make motor cars at Chatham, Ont. Incorporators: J. Dallas Dort of Flint, Mich., Robert Gray and William Murray Gray of Chatham, Ont.

The Algoma Nickel Mining Co. has been incorporated at Toronto with a capital of $10,000 to acquire and develop mines and mineral lands. Head office at Toronto. Incorporators: George Hugh Baird and Henry Nicol Baird, of Toronto.

The Maple Leaf Motors, Ltd., has been incorporated at Ottawa, with a capital of $750,000, to manufacture automobiles and motor cycles, etc., at Brantford, Ont. Incorporators—James Harley and Edmund Sweet, of Brantford, Ont.

The Reginal Construction Co. has been incorporated at Ottawa, with a capital of $100,000, to carry on business as contractors. Head office at Mont-

real, Que. Incorporators—Charles Gaspard Hebert and Arthur Laberge, of Montreal.

The Utilities Eqipment Co. has been incorporated at Toronto with a capital of $40,000 to manufacture electrical and mechanical apparatus and appliances at Toronto. Incorporators: William Davidson and John Calvin McFarlane, of Toronto, Ont.

The Dominion Magnesite Co. has been incorporated at Ottawa, with a capital of $100,000, to develop and operate mines, minerals, mining lands at Calumet, Que. Incorporators—Walter Robert Lorimer Shanks, Francis George Bush, of Montreal.

The Transcona Shell Co. has been incorporated at Ottawa, with a capital of $50,000, to manufacture shells, bombs and munitions of all kinds. Head office is at Montreal. Incorporators—F. G. Bush, G. H. Drennan and H. W. Jackson, all of Montreal.

Cleveland, Ltd., has been incorporated at Ottawa, with a capital of $40,000, to purchase a certain secret process known as the "Cleveland Process." Head office at St. John, N.B. Incorporators—Isaac MacDonald and Laurence Alexander Barry, of Halifax, N.S.

The E. W. Jeffres, Ltd., has been incorporated at Ottawa with a capital of $500,000 to carry on the business of manufacturing chemists at Walkerville, Ont. Incorporators: Edward Worsham Jeffres, of Detroit, Mich., and Albert J. Gordon, of Walkerville, Ont.

The Central Engineering Co. has been incorporated at Ottawa with a capital of $25,000 to carry on business as general dealers in and manufacturers of machinery at Montreal, Que. Incorporators: Thomas Arnold, Joseph Atter and Herbert M. Ewan, all of Montreal.

The Dominion Copper Products Co. has been incorporated at Ottawa, with a capital of $400,000, to manufacture articles made of copper, brass and all other metals, at Montreal. Incorporators—Walter Lorrimer Shanks and Francis George Bush, of Montreal.

The Canadian Dove-Smith Co. has been incorporated at Toronto with a capital of $40,000, to manufacture machinery and munitions of war at Toronto. Incorporators—Roderick George Kembly, Joseph Henry Harker, and Newton Howard Manning, all of Toronto, Ont.

Greenleafs, Ltd., has been incorporated at Toronto with a capital of $40,000, to purchase the business of Greenleaf & Son, machinists, electricians, automobile repairers, at Belleville, Ont.

ADVERTISING.

Advertising in a trade paper is simply stating openly who you are and what your business is. It is pointing out to the readers that you have something of service for them, a commodity of usefulness to profit both you and them. The only men who do not advertise are those who have nothing to offer. They are dead, even if they do not know it.

Incorporators—Henry Wilbur Greenleaf and Charles Orlando Greenleaf, of Belleville, Ont.

Yukon Copper Co. has been incorporated at Ottawa, with a capital of $200,000, to carry on the business of mining and smelting copper. Head office at Ottawa. Incorporators—W. D. Grenough, of Whitehorse, Y.T.; Alfred Thompson, of Dawson, Y.T., and J. F. Smellie, of Ottawa.

The Gunn Electric Co. has been incorporated at Ottawa, with a capital of $20,000, to manufacture electrical hydraulic, mechanical and other machinery at Montreal, Que. Incorporators—Edward James Gunn, William James Shaughnessy and Chilion Graves Heward, all of Montreal.

The Wizard Tire Inflator and Fire Extinguisher Co. has been incorporated at Ottawa, with a capital of $50,000, to manufacture tire inflators and fire extinguishers, fluid air, gas or other receptacles, at Toronto. Incorporators—John Edward Carroll, of Philadelphia, Pa., and James Douglas McWilliams, of Toronto, Ont.

TENDERS FOR SOUTH AFRICAN REFRIGERATING PLANT

THERE have been forwarded to the Department of Trade and Commerce, Ottawa, by W. J. Egan, Trade Commissioner, Cape Town, specifications and plans for the supply and erection of an ice-making and refrigerating plant and for the fitting up of refrigerating chambers at the municipal abattoirs, Newton, Johannesburg. The contract calls for the supply and erection at the above abattoirs of an ice-making and refrigerating plant with necessary foundations, etc., complete; all insulated walls, partitions, floors, ceilings, doors, etc., necessary to construct the various compartments in basement with all work required to leave same in complete working order; two lifts, with all operating gear, gates, etc., complete; all running rails for conveying, and hanging rails for hanging carcases, complete with all switches, hangers, runners, etc., in basement and lifts. Tenders for the above are to be in the tender box, municipal offices, Johannesburg, by or before noon on Thursday, December 30, 1915. Specifications and drawings may be inspected at the Department of Trade and Commerce, Ottawa. (Refer File No. A-1842.)

MONTREAL DRY DOCK & SHIP REPAIRING CO.

WHEN the steamer Rock Ferry went into dock at the end of Wellington Basin on Mill Street, Montreal, on November

6, to have her rudder repaired, she inaugurated a new era in the work to be done by the Montreal Dry Dock & Ship Repairing Co.

For nearly four years this concern has been doing work at the dock, which before that time was known as the Tate Dry Dock. All this summer work has been proceeding at deepening the dry dock so that its scope could be greatly extended. On Friday, November 5, a group of prominent business and shipping men were shown over the plant to see for themselves that now the dock can take any lake steamer which comes through the Lachine Canal.

The dock has been deepened four feet for 250 feet in length, and a new concrete bottom laid. The Rock Ferry is 260 feet long, and draws 11 feet when light, an indication of the capacity of the new dock. There is a good plant for iron work, completely supplied with air and electric tools. The dock is 50 feet wide and the blocks three feet six inches high. The entire length of the dock is 430 feet.

Among those present were—Thomas Hall, of the Hall Engineering Works, who is managing director of the Montreal Dry Dock & Ship Repairing Co.; F. H. Fox, secretary-treasurer; Captain Johnson, marine superintendent of the Canada Steamship Lines; E. Marceau, chief engineer Quebec Canals; D. O'Brien, superintendent Lachine Canal; Captain Archibald Reid, port warden; Captain J. N. Bales, assistant port warden; L. L. Henderson, manager and director Montreal Transportation Co.; F. W. Cowie, chief engineer Harbor Commission; A. Kastella, chief engineer Department of Public Works; George Hadrill, secretary, Montreal Board of Trade; Captain J. O. Grey, Frank Wright, and Ralph Hall, the last three from the Hall Engineering Works.

MUNITIONS EXPORTS FROM THE UNITED STATES

EXPORTS of war materials from the United States now average more than $1,000,000 a day, according to a statement issued yesterday by the Foreign Trade Department of the National City Bank. From the port of New York alone the exports in September included $6,500,000 worth of gunpowder, $3,500,000 worth of shells and explosive projectiles, $1,250,000 of cartridges, nearly $1,000,000 of dynamite, cordite and trinitrotoluol, $500,000 worth of primers and fuses, $1,000,000 worth of empty projectiles, and nearly $1,000,000 worth of firearms.

In addition there were shipped in September $1,000,000 of military goods, nearly $1,000,000 of aeroplanes and more than $6,000,000 worth of auto trucks. There also were enormous shipments of copper, lead, spelter, hospital goods, harness and saddlery. Most of the shipments were to Great Britain, France and Russia.

Catalogues

Don't Waste Your Fuel is the title of a folder issued by the James Morrison Brass Mfg. Co., Toronto. The folder describes and illustrates two patterns of

If what you want is not advertised in this issue consult the Buyers' Directory at the back.

recording gauges for steam pressure, vacuum and temperature ranges.

Temperature Booster.—The W. E. Clark Co., Toronto, have issued a folder describing the Clark temperature booster. This is a device for increasing the circulation of the water in hot water heating systems. A full description covering the construction and method of operation is given, accompanied by sectional views.

Shop Furnaces made by the American Shop Equipment Co., Chicago, Ill., are the subject of a supplementary bulletin recently issued. The lines briefly described include portable and stationary rivet forges, welding and forge furnaces, annealing, tempering and hardening furnaces, etc. The bulletin contains complete export shipping data for each product listed.

Heat Generator.—A booklet describing the "Knickerbocker" heat generator made by the James Morrison Brass Mfg. Co., Toronto. This appliance, which is designed for hot water heating systems, is illustrated and described, the illustrations including a number of diagrams of heating systems showing location of the generator. The method of installing the generator is described and also the benefits to be derived from its use.

Piston Rings—"To Save and to Hold Power"—is the title of a bulletin issued by W. H. Banfield & Sons, Toronto, Ont., and describing the "Leak-Proof" piston ring. The bulletin first of all deals with piston rings in a general way and then proceeds to describe in detail the principal features of "Leak Proof" ring. The method of making these rings is described, followed by instructions for installing and the variety of uses.

The Lighting of Textile Mills with Edison Mazda lamps is the title of bulletin No. 4906 distributed by the Canadian General Electric Co., Toronto. The bulletin contains a number of excellent half-tones showing interior views of textile mills where "Mazda" lamps are installed. The reading matter deals with "Mazda" lamps as applied to the illumination of textile mills, while a variety of types of lamp are illustrated. Tables are included giving data covering these lamps.

Book Review

Forging of Iron and Steel, by William Allyn Richards, B.S. in M.E., 219 pages 8 in. x 5 in., 337 illustrations. Published by the D. Van Nostrand Co., New York. Price $1.50 net. This is a new text book for the use of students in colleges, sec-

Steel Market

Owing to the fact that American mills have withdrawn prices on a number of steel products from this market, and that they are not for the present soliciting business in Canada, prices on Pittsburgh bars, plates and shapes will not be given in the selected market quotations until further notice. Steel companies in the States are unable to accept new business from this market as their output is booked up for several months ahead and furthermore prices are so variable that a firm quotation cannot be listed with any degree of accuracy.

Canadian mills have advanced prices on steel bars 25 cents, and are quoting $2.75 per 100 pounds, Toronto. Quotations on iron bars are unchanged at $2.50 per 100 pounds. Prices on steel bars are subject to change without notice and quotations are made only for immediate acceptance. The market is very strong and active and every indication points to still higher levels. The demand for steel for shells continues to increase and the capacity of the mills will be taxed to the limit to take care of the tonnage that will be required for the new orders for munitions. The steel industry is passing through a phenomenal period of prosperity which will benefit the trade to a degree never anticipated as recently as twelve months ago. No other price changes except the ones noted above have been made this week, but boiler tubes and boiler plates will no doubt advance in the near future. Bolts, nuts and wrought iron pipe are very firm and higher prices are anticipated.

Prices of galvanized sheets are firm and are expected to advance. The market is unsettled and it is said that some makers have practically withdrawn from the market. The scarcity of steel is affecting the sheet makers, acid is scarce and high, while the abnormal price of spelter is also an important factor in the situation.

In the United States the market is very strong and prices on steel products continue to advance. Steel companies are extending their plants and are operating at capacity. Many mills have their output sold for four and five months ahead, and some for the first half of next year. There is a very heavy demand for steel bars for munitions and prices are going higher. Steel bars, plates and shapes are now being quoted at 1.70c Pittsburgh. Bessemer and forging billets are higher and are being quoted at $27 and $48 per ton Pittsburgh, respectively. Wire rods have advanced, and are now quoted at $37 f.o.b. Pittsburgh. Black sheets are higher at $2.25 Pittsburgh.

Pig Iron

The market is strong and prices of domestic and American pig iron are higher. Hamilton and Victoria brands have advanced 75c and are now quoted at $21.75 per ton, Toronto. Grey forge has advanced to $15.95 Pittsburgh, while Lake Superior charcoal is now quoted at $17.25 f.o.b. Chicago. The pig iron market is becoming more active in sympathy with that of steel. There is a heavy demand for steel making grades. Canadian consumers are buying heavily in the States, but cannot get all the tonnage they require.

Old Materials

The market is firm with improved demand for copper scrap and heavy melting steel. Prices are considerably firmer, and zinc has advanced 1c, being now quoted at 12c per pound. No.1 wrought iron and No. 1 machinery cast iron are both stronger and higher. All grades of grass are in good demand and prices are firm.

ALLIES PURCHASING AGENTS

The Trade and Commerce Department, Ottawa, has published the following list of purchasing agents for military purposes for the allied Governments:

International Purchasing Commission, India House, Kingsway, London, Eng.

French.—Hudson Bay Co., 56 McGill Street, Montreal; Captain Lafoulloux, Hotel Brevort, New York; Direction de l'Intendence Ministere de la Guerre, Bordeaux, France; M. De la Chaume, 28 Broadway, Westminster, London.

Russian.—Messrs. S. Ruperti and Alexsieff, care Military Atache, Russian Embassy, Washington, D.C.

Machine Tools

The situation in the machine tool market is much the same as last week. Dealers are very busy figuring on tools for the large shells and have sold a number of lathes for machining the 6-in. type. A large number of lathes, 24-in. to 30-in. swing, will be required for the large shells, and it is understood that a considerable amount of business is ready to be placed by the various firms who are preparing to undertake their manufacture. Prices of lathes and other tools have advanced considerably, but deliveries on the large size lathes are not as backward as on the smaller tools. Second-hand tools suitable for shell work have risen in price, and are not so easy to obtain as formerly, the market having become depleted.

Supplies

The market continues active and prices are firm. There are no price changes of importance to note this week but there is an upward tendency in some lines. Linseed oil is expected to advance again. Waste is firm and in good demand. Higher prices are anticipated for red lead, and lead wool may also advance.

Metals

The market is steady and there are no price changes to note with the single exception of spelter which has advanced again. The tin market which advanced sharply last week on a report that the Suez Canal was closed is now weak as a result of this rumor having been proved incorrest. Copper is higher in London, but unchanged here. The advance in spelter is due to a scarcity of this metal and an apparent attempt to excite the market. The lead market is firm but unchanged. Considerable strength has developed in the antimony market and prices are very firm. The scarcity of aluminum continues and prices are nominal.

Tin.—The strong market which developed last week has not been maintained and the market is now dull and weak. The Suez Canal scare had apparently no foundation in fact, consequently the market fell off, but recovered later. There is a scarcity of spot tin and should business improve the price might advance. Local quotations are unchanged at 48c per pound.

Copper.—The market is strong and higher in London. There has been some heavy buying recently, and it is thought that the market will go higher before the movement stops. Local quotations are firm and unchanged at 20c per pound.

Spelter.—The marke is unsettled and quotations nominal. A scarcity of spelter in London has resulted in a further advance in prices for prompt and end of November requirements; futures, however, are selling at a discount. Spelter has advanced 2c and quotations are nominal at 20c per pound.

Lead.—The market is quiet but firm. The "Trust" price is being well held at $5.25, New York, and it is probable that it may advance. Local quotations are unchanged at 7c per pound.

Antimony.—The market is very strong with an upward tendency. There is a scarcity of spot antimony and a large business is being done in futures. In the London market, the price of antimony is controlled by the British Government which helps to steady the market. Local quotations are firm and unchanged at 40c per pound.

Aluminum. — The situation is unchanged and supplies are still very difficult to obtain. Quotations are unchanged at 65c per pound.

Advertisers Cannot Be Overlooked

Being in the background of a manufacturer's mind at a moment which decides the direction business shall take, may mean serious losses. When you advertise you cannot be overlooked—you always receive consideration—a consideration above that accorded the house that does not see the benefit of talking to the manufacturer when he has the time to listen — when he sits down to read *Canadian Machinery*.

GRAIN EXPORTS REDUCED

WITH little prospect of improved conditions in the month of November, reports of this year's grain exports through the port of Montreal up to the end of October show a distinct falling off as compared with the corresponding period last year, while a large increase of grain shipped from many of the Atlantic ports of the United States is recorded.

The total amount of grain exported from Montreal to October 31 of the current year is 34,664,528 bushels, according to reports compiled by the Board of Trade, as compared with 58,112,000 bushels for the corresponding period of 1914, a decrease of 23,447,472 bushels. The total for this year is made up of 27,807,108 bushels wheat, and 5,886,000 bushels oats, the remainder being corn and barley.

Total exports of grain from St. John, N.B., for the same period, show a smaller diminution as compared with last year, the figures, as compiled by the Consolidated News Statistics and Transportation Bureau, of Philadelphia, being 5,174,000 bushels for 1915, and 5,556,000 bushels for 1914.

OCTOBER EXPORTS NEARLY DOUBLED

THE feature of the monthly statement of Canada's trade, issued on November 19, by the Hon. J. D. Reid, Minister of Customs, is the very substantial increase in the volume of exports. For the month of October last, Canada exported eighty million dollars worth of goods, or nearly double the exports for the corresponding month of 1914.

There are increases all along the line, the chief being agriculture, $39,833,000, compared with $17,900,000 for October, 1914; animals and their product, October, 1915, $12,000,000; October, 1914, $8,000,000; manufactured goods, October, 1915, $12,800,000; October, 1914, $7,100,000; minerals, $6,600,000, compared with $5,104,000, while there is a substantial increase in the export of fisheries and lumber.

The exports for October doubled the imports for the same period, the imports being $39,000,000, made up of $22,800,000 dutiable goods, and $16,700,000 free goods.

The total Canadian trade for October, 1915, was $150,000,000, compared with $139,000,000 for the corresponding month last year. The statement shows that the Canadian trade for the seven months ended October last was $709,000,000, compared with $640,000,000 for the corresponding seven months of 1914. For the seven months ended October last, the exports of agricultural products reached $100,000,000, compared with $75,000,000 for the corresponding period of 1914. For the seven months of the present fiscal year the exports were largely in excess of the imports, the latter being $253,000,000, and the domestic exports $336,000,000.

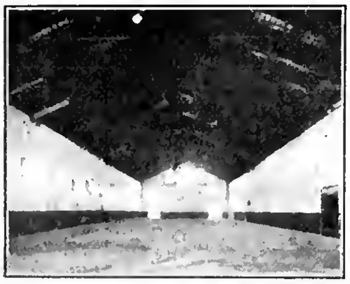
JOHNS-MANVILLE SERVICE COVERS THE CONTINENT

JOHNS-MANVILLE SERVICE

JOHNS-MANVILLE SERVICE COVERS THE CONTINENT

IN every important city of North America the Johns-Manville purchaser finds Johns-Manville Service. It exists for his benefit and in order that every J-M Product sold him may render continuous satisfaction.

Actual service has proved that J-M Fire-proof Cold Water Paint reduces lighting bills at least 25%



Before using J-M Cold Water Paint

After using J-M Cold Water Paint

It brightens up corners and dark places, thereby making daylight last longer and necessitating the use of fewer lights when working at night.

And in addition to this great saving, the productiveness of employees is increased from 10 to 40%, according to local conditions.

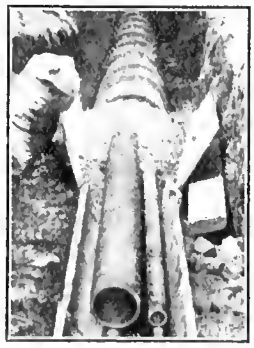
J-M Cold Water Paint is composed of various minerals and cementing compounds and is mixed with ordinary water, which costs you practically nothing. Due to this economy, this paint costs only a fraction as much as oil paints. It covers a greater area and one layer covers better than two layers of oil paint.

Contains no oil, alkali, lime or injurious chemicals, so won't discolor with age nor harm hands or clothing. Being absolutely fireproof it is approved by the Fire Underwriters, therefore insurance premiums are often reduced where it is used.

J-M Fireproof Cold Water Paint, when applied according to simple directions, forms a hard, firm, sanitary and odorless coating which will not chalk, scale, peel or rub off.

The method to be used to carry steam underground is no longer a matter of experiment

Because facts point to the J-M Sectional Conduit System as being most efficient and economical. There are several considerations that must be given due thought in every underground steam line. (1) Efficiency—the ratio of the steam you send through the line to that which is received at the other end. (2) Cost—meaning total cost: that is, first cost, repairs, inspection and maintenance. (3) Durability—How long it will last, or "how soon must this system be renewed." (4) Depreciation—which means the money you must earn, and save, to pay for the renewal of the installation when the present one is gone.



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is the logical choice under all these considerations.
Efficiency—90% and up. Cost—lowest yet. Life—endless. Depreciation—negligible.
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The Canadian H. W. Johns-Manville Co., Ltd.

TORONTO MONTREAL WINNIPEG VANCOUVER

440

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Vancouver, B.C.—The Shell Company will build an oil refinery on Burrard Inlet.

Seaforth, Ont.—The Robert Bell Engine Co. have been awarded a contract for shells.

Hamilton, Ont.—The Acme Stamping Tool Works will make an extension to their plant to cost $3,000.

Vancouver, B.C.—The molding shops of the Vancouver Engineering Works, were damaged in a recent fire.

Leamington, Ont.—The town council will purchase two 110 h.p. return-tube boilers for the pumping station.

Montreal, Que.—The Castings Co. of Canada, which was recently incorporated, will build a foundry at Valleyfield, near here.

Fort William, Ont.—The Fort William Coal Docks Company will build an extensive addition to its plant on Mission River, to cost $200,000.

Petrolia, Ont.—A beet sugar refinery will probably be built by the Marine City Sugar Co. The cost of buildings and plant is estimated at $800,000.

Collingwood, Ont.—It is reported that the Imperial Steel & Wire Co. have received an order for shells in addition to the order for war material recently announced.

Orillia, Ont.—The J. R. Eaton & Sons have received a contract for 25,000 six-inch shells. The company have for some time been working on a large order for ammunition boxes.

Galt, Ont.—Owing to trouble at the pumping station, the Waterworks Commission have practically decided to purchase another electric motor to drive one of the turbine pumps.

Welland, Ont.—The Electric Steel & Metals Co. are building a new machine shop 300 ft. long by 50 ft. wide, and an office building 50 ft. by 40 ft. An electric furnace is also being installed for turning out shell blanks.

Montreal, P. Q.—The Standard Steel Co., which has recently been incorporated, has taken over an existing foundry on Atlantic avenue. The plant will be equipped and operated as a steel foundry. An extension to the plant is contemplated.

London, Ont.—Plans for an addition to the Ford factory on Waterloo Street are being prepared, although no construction work will be started this year. The company has purchased a site, 180 by 232 feet, in the rear of its present building, on which the new structure will be erected.

Dawson, Y. T.—The steam generating plant of the Canadian-Klondike Mining Co. was completely destroyed by fire Oct. 30. The plant was used for driving dredges, heating the company's shops, etc. The machinery burned included three large water-tube boilers and a 400 k.w. steam turbine. The plant is to be rebuilt on a larger scale.

Welland, Ont.—The Canada Forge Co. will build an extension to their plant. The new building will have a ground area of 180 x 80 feet, and will be of structural steel. The cost is estimated at $20,000, and the equipment to be installed will cost $100,000. The building will be used for four additional hydraulic presses for making six-inch high-explosive shells. T. J. Dillon is manager.

Vancouver, B.C.—The recently organized Port Moody Steel Works, Ltd., are now busy clearing their site at Port Moody and anticipate within a short time starting construction work on their buildings, being far enough advanced early in the new year to start operations. The company has a 100-acre site at Port Moody and the council of that place have guaranteed bonds to the extent of $100,000.

Electrical

Granton, Ont.—A Hydro-Electric system will be installed here at a cost of $5,000.

Forest, Ont.—The Town Council contemplate installing a Hydro-Electric system.

Verdun, Que.—Council is considering the extension of the electric lighting system.

Granton, Ont.—The Township of Biddulph purpose spending $3,500 on a Hydro-Electric distribution system. A by-law will be voted on .

Petrolia, Ont.—Construction work on the hydro system has been suspended because the Commission's recommendations have not been carried out.

Orangeville, Ont.—The county has passed a by-law guaranteeing the bonds of the corporation of the Town of Orangeville to the amount of $33,000, repayable in 20 years, for the purchase of the plant of the Pine River Light and Power Co., and to provide for the cost of a plant to distribute electric power to be supplied by the Hydro-Electric Power Commission of Ontario.

Eugenia Falls Plant.—The new power plant at Eugenia Falls owned by the Ontario Hydro-Electric Commission was formerly opened by Sir Adam Beck on November 18th. The plant will serve a large section of the Georgian Bay district with electrical energy. The present capacity of the plant is 4,000 h.p., but 8,000 h.p. can be developed. The total head of water available is 450 feet. The plant represents a capital investment of $600,000 and transmission lines and transformer stations $500,000 more. Should the circumstances warrant, the Eugenia Falls plant can be linked up with the other two plants on the Severn, namely, Big Chute and Wasdall's Falls.

Municipal

London, Ont. — The contemplated waterworks extensions include a pumping installation.

Dryden, Ont.—The Town Council are considering the question of installing a waterworks system.

Port Dover, Ont.—The town council contemplate making extensions to the waterworks system.

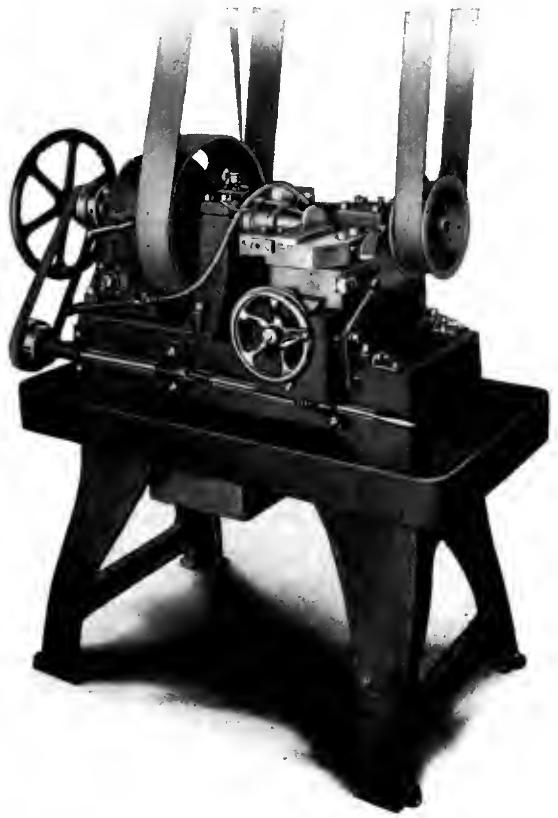
Southampton, Ont.—The installation of a hydro-electric system is under consideration by the town council.

West Lorne, Ont.—A by-law will be prepared to submit to the ratepayers to borrow $8,000 for a hydro-electric system.

Owen Sound, Ont.—A by-law will be voted on by the ratepayers to authorize a loan of $12,000 to the Owen Sound Shoe Mfg. Co.

Peterborough, Ont.—A by-lay is being prepared covering a loan of $3,500 to J. C. Ellis, who proposes building a mattress and bed-spring factory.

THE BANFIELD PLUG MILLER



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The machine is equipped with quick draw in collet. Drive pulley 16" x 4", with bronze bush having cut jaw clutch for turning and facing. Bronze worm gear 74 to 1 ratio, with cut jaw clutch for milling, driven by 10" x 1½" flanged pulley. The milling cutter is driven by an 8" x 2½" flanged pulley. Tool post carriage is equipped with power feed (two speeds) having automatic stop. Power feed pump with relief valve driven from worm shaft (*all drives direct from main line shaft*). Rigidly built, simple and economical to operate.

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5-in., 6-in., 8-in. and 9.2-in. Shells

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ENGINEERS AND MANUFACTURERS

20 Cooper Avenue - TORONTO

If what you want is not advertised in this issue consult the Buyers' Directory at the back.

Brockville, Ont. The ratepayers have voted in favor of granting exemption of taxes to the Newell Manufacturing Co., who propose establishing a branch factory here.

St. Marys, Ont.—There is a prospect of St. Marys getting a new industry. A Michigan concern has written to council asking what terms the town could offer should it locate here.

Edmonton, Alta.—The City Council has decided to submit a by-law on December 13 authorizing an expenditure of $275,000 on the construction of a sewage disposal plant.

Regina, Sask. -The city will install a new pumping unit at its waterworks plant to be driven by electricity, and have a capacity of 2,500,000 gal. per day and to cost $12,000. George Beach is the clerk.

Orillia, Ont.—The by-law for raising $50,000 for the purpose of rebuilding the town hall according to the plans prepared by Messrs. Burke, Horwood & White, was decisively defeated by the ratepayers on Nov. 17.

Port Dover, Ont.—Port Dover may shortly install a waterworks system. The town has two alternatives. Water can be brought by gravitation from Doan's Springs, which are two miles from the town. The other way is to take the water out of Lake Erie. It is proposed, if the latter plan is chosen, to build an intake pipe of 1,200 feet, and then have mechanical filters, which would be established near The Globe Park. E. A. James, of Toronto, is the engineer.

Brockville, Ont.—Seven tenders have been received by the Water and Light Commission for the proposed filter plant. The following alternative proposals are being considered: Barber & Grant, Toronto, A. $34,000; B, $94,500. New York Continental Jewel Co., A. $35,000; B. $87,128. Pittsburgh Filter Co., A, $42,-916; B. $97,746. Roberts Filter Co., Darby, Pa., A. $39,000; B. $95,193; C, equipment only, $36,500. Norwood Filter Co., Cowansville, Que., A. $40,800; B, $94,057.

General Industrial

St. Anns, N.S.—The Cape Breton Pulp Co. will rebuild their plant which was recently destroyed by fire.

Halifax, N.S.—The Brandram-Henderson Co., paint and white lead manufacturers, will build a new factory.

Fort Erie, Ont.—The International Safe Co. will build an extension to their factory. S. A. Waugh is president.

Parry Sound, Ont.—An explosion at Nobel last Monday wrecked a section of the plant of the Canadian Explosives, Ltd.

Kingston, Ont.—The Separate School Board are considering the question of installing fire escapes on the school building here.

Ingersoll, Ont.—The Waterhouse Knitting Mills will be extended, the factory remodeled and new machinery installed. Thomas Waterhouse is the president.

Haileybury, Ont.—It is understood that the purchase from C. A. Foster of his sawmill here by the Riordon Paper Mills of Montreal, will be followed by the building of a large pulp and paper mill.

Tenders

Grand'Mere, Que.—Tenders are being received for the supply of one 500 h.p. turbine and dynamo. Engineer, L. S. Pariseau, Montreal.

St. Hyacinthe, Que.—Tenders will be received up to December 14, for a mechanical filter plant. Plans and specifications may be obtained at the office of Hector Cadieux, city engineer.

Toronto, Ont.—Tenders will be received until Tuesday, Nov. 23, 1915, for

automatic roller fire doors at new Central Technical School. Specifications may be seen and all information obtained at the office of the Superintendent of Buildings, City Hall.

Toronto, Ont.—Tenders will be received by the Board of Education until Friday, Nov. 26, 1915, for ventilating fans, iron fence, ash hoist, local telephones, bronze tablets, steam fittings, etc. Specifications may be seen and all information obtained at the office of the Superintendent of Buildings, City Hall.

Halifax, N.S.—Tenders will be received by the Governor of the Province of Macao, up till January 8, 1916, for the supply of a steel, self-propelling dredge for the use of the Macao Harbor Works. Full particulars may be obtained at the office of Fred. H. Oxley, Consul for Portugal, Keith Bldg., Halifax, N.S.

Toronto, Ont.—Tenders will be received by the Chairman, Board of Control, City Hall, up to Tuesday, December 7, 1915, for the supply and erection of a mechanical mixing apparatus for the high-level chlorination plant, Wilton avenue and Don River; also the supply and erection of a mechanical mixing apparatus for the low-level chlorination plant, Eastern avenue and Don River. Specifications and forms of tender may be obtained at the Works Department, Room 6, City Hall.

Building Notes

Sarnia, Ont.—A new public school building will be built at an estimated cost of $50,000.

Montreal, Que.—The D. H. Hogg Co. will build a factory to cost $5,000. A building permit has been obtained.

Montreal, Que.—A building permit has been issued to the City Ice Co., who propose building a plant at a cost of $2,500.

Toronto, Ont.—The foundations have been completed for the new offices for the Board of Education. The building will cost $100,000.

Vancouver, B.C.—A Union Station for the Great Northern and Northern Pacific Railways will be built on a site purchased on False Creek. Fred. L. Townley, of Vancouver, is the architect.

Toronto, Ont.—The Board of Education have obtained a permit to erect the new Park School, costing $186,000. The plans call for the erection of a three-storey brick building at 126 Sydenham street.

Contracts Awarded

Toronto, Ont.—The contract for building the new incinerator has been awarded to E. H. Thomas of this city at $84,500.

Hespeler, Ont.—Grill Bros. have been awarded the contract for the waterworks pumping station and will start work at once.

Woodstock, Ont.—The contract for the new steel bridge over Thames street has been awarded to the Hamilton Bridge Co., Hamilton, Ont., for $3,190.

Berlin, Ont. — The Canadian Allis-Chalmers, Ltd., Toronto, have been awarded the contract for the pumps for the new sewage disposal plant. The amount of the tender was $4,492.

Personal

Col. Frederic Nicholls, president of the Dominion Steel Corporation, has arrived in London on a visit to the Old Country.

Colin C. Campbell, senior member of the firm of R. Campbell & Sons, pottery manufacturers of Hamilton, Ont., died on Nov. 15, aged 53 years.

Alfred W. Smithers, chairman of the English Board of the Grand Trunk Pacific Railway, who has been spending several weeks in Ottawa and Montreal, sails this week for England.

Trade Gossip

The Munitions Committee has ruled that the price of steel for ammunition to be made in Canada shall not exceed 3½ cents a pound.

The Canada Cement Co., Montreal, which recently received a large order for the manufacture of shells, will install an electric furnace for the purpose of making the steel required.

Cobourg, Ont.—The machinery in the old Provincial Steel Co.'s plant here has been purchased by the A. R. Williams Machinery Co., of Toronto, and will be shipped to Victoria, B.C.

Calgary, Alta. — The Calgary Iron Works has received an order for an additional 5,000 shells. The Buckeye Machinery Co. is about to get another contract. The latter company may get an order for 50,000 shells.

South Porcupine, Ont.—By changing the gold extraction system from the old amalgamation process to cyanide it is expected a greater recovery will be made

at the Dome Lake mill. The cyanide equipment is now being added.

Amherst, N.S.—The buildings, plant and machinery of the Hewson Pure Wool Textiles Co. was sold on Nov. 17 to E. F. Stevens of Halifax, N.S., representing the bond holders, for $102,000. The concern will be reorganized.

The Pine River Light and Power Co. power house, transmission lines, etc., within the corporation limits of Shelburne, N.S., will pass into the possession of the town December 1, the necessary deal having been closed last week. The town will pay $4,360 for the outfit.

Gold Medal for G. T. R.—The Grand Trunk system has been awarded the gold medal (highest award) and diploma for its exhibit at the Panama-Pacific International Exposition at San Francisco. The exhibit formed scenic, agricultural and industrial resources of Canada.

Vancouver, B.C.—Applications for all the forty acres of the False Creek foreshore which is being filled in under the direction of the Board of Harbor Commissioners, have been received, according to the members of the board. Among those who desire to lease sites are a number of local firms, but a number of outside companies desire to establish industries here.

Marshall-Weden Machine Gun.—William Marshall, consulting engineer of Toronto, one of the inventors of the Marshall-Weden machine gun, has sold to the St. Louis Car Co. the right to manufacture the gun in all countries of the world except Canada. It is stated that he will receive about $30,000,000 in commissions on a large order from the French and Russian governments.

Demand for Old Rails.—The inability of the mills of the Pittsburgh district to accept orders for steel rails for quick delivery has resulted in numerous enquiries from foreign governments for second-hand rails. It was learned last Friday that agents for Italy, Switzerland and the Belgian Congo are trying to place orders in Pittsburgh for 50,000 tons of old rails, to be used chiefly for repair work on Continental railroad lines.

Empire Reconstruction.—Lord Rosebery, speaking on Empire reconstruction, said that Imperial sentiment in Canada and Australia was at one time a pale shadow of what it is now. The blood which the Dominions have shed in our behalf must in consequence change the the Empire's constitution. He could not doubt that when the efforts of the Peace Congress were over there will appear a gigantic task of reorganization of the British Empire. "We should have to clean the whole of our slate before writing the new organization upon it," he said.

The Dominion Steel Corporation is devoting particular attention to the production of shell steel, which is in such active demand, and is leaving the turning out of shells to the other companies. The management went into the matter of shell output with the old shell committee, but did not see its way clear to take on the heavy capital outlay incident to taking on shell production as well. It is stated in steel circles that further foreign orders, particularly Russian, are now available, if the Canadian mills can give any guarantee of being able to make deliveries as required.

Dominion Industries Will Be Mobilized.—The Economic and Development Commission is receiving suggestions from leading organizations interested in agriculture, stock raising, fruit growing, marketing transportation, immigration and other matters affecting the progress of Canada. Questions requiring the consideration of technical experts will be dealt with by proper special committees of inquiry. It is the aim of the commission to proceed as rapidly as possible toward assisting in the mobilization of the agricultural and industrial resources so that Canada may be in the best possible position to meet after-war conditions.

Guelph, Ont.—Chief Engineer Gaby of the Hydro-Electric, with his staff, has been in the city recently in consultation with the City Council. The members of council went over the routes proposed by the Hydro engineers and others that had been suggested by the city engineer. The route favored by the city engineer would cost, Mr. Gaby stated, $150,000 more than the one drawn by the Hydro engineers in the first place. At the final meeting of council a resolution was put through favoring the original plans submitted by the Hydro engineers. This means that the original plans, on which Guelph's share was placed at $700,000, will be submitted to the ratepayers at the January elections.

Steel for U.S. Battleships.—Congress may be asked to place a temporary embargo on exports of structural steel to the European belligerents in order to afford a sufficient supply of the metal for use in the construction of the two battleships, bids for which were opened at the Navy Department last week. This plan is suggested as a result of the disclosure that neither of the new battleships can be laid down before next summer because of a lack of steel. The entire output of the American steel plants, it is said, has been taken by the warring nations. Secretary of the Navy Daniels, who is deeply concerned over the fact, hints that unless steel plants can be in-

duced to insure preference for Government orders Congress may be urged to act.

Imported Shell Forgings.—A duty of 32¼ per cent. is imposed on shell forgings entering Canada from the United States. Up to the present it has been deemed wise by the Canadian Government not to remove the tariff, as some twelve Canadian companies have been turning out forgings at a rate sufficient to supply the needs of other manufacturers who merely finish shells. Since the recent further distribution of shell orders by the Munitions Committee at Ottawa it is, however considered advisable in some quarters to have the duty removed, on the ground that the output of shells in Canada would be increased by the importation of forgings from the United States. It is announced from Ottawa that the Munitions Committee has fixed the price of steel for ammunition to be made in Canada. It must not exceed 3½c per pound.

After the war what? We cannot go back to the status quo ante. Class jealousy is breaking down in the trenches. Two million soldiers will come back appreciating the meaning of the phrase "an officer and a gentleman;" 50,000 officers one and all saying that the men are splendid. . . . I believe that it is good business to treat the workman well, to welcome him as a partner—a junior partner who is bound to take a more prominent share in the management and the profits of the concern in the near future. Good business or not, it is the clear duty of every employer to-day. We have had enough of the workman striking against the master in South Wales, of the master hailing the workman before munition tribunals on Tyne and Clyde, while the brothers of each are dying side by side in Flanders and Gallipoli.—Chairman of a Controlled Establishment.

The Willys-Overland, Ltd., has recently been incorporated with a capital of $6,000,000, and with head office in Toronto. The new company will take over the complete motor business of the Russel Motor Car Co., Ltd., and the complete Canadian business of the Willys-Overland Co. The intention is not merely to assemble, but to provide for the complete manufacture at the West Toronto plant of the Overland and Knight motor cars. John N. Willys, head of the Willys-Overland Co., of Toledo, will become president of the new company, and T. A. Russell, present vice-president of the Russell Motor Car Co., will be vice-president. Lloyd Harris will also be a member of the board, and there will be other Canadian directors. It is understood that under the new arrangement the Russell Motor Car Co. will continue

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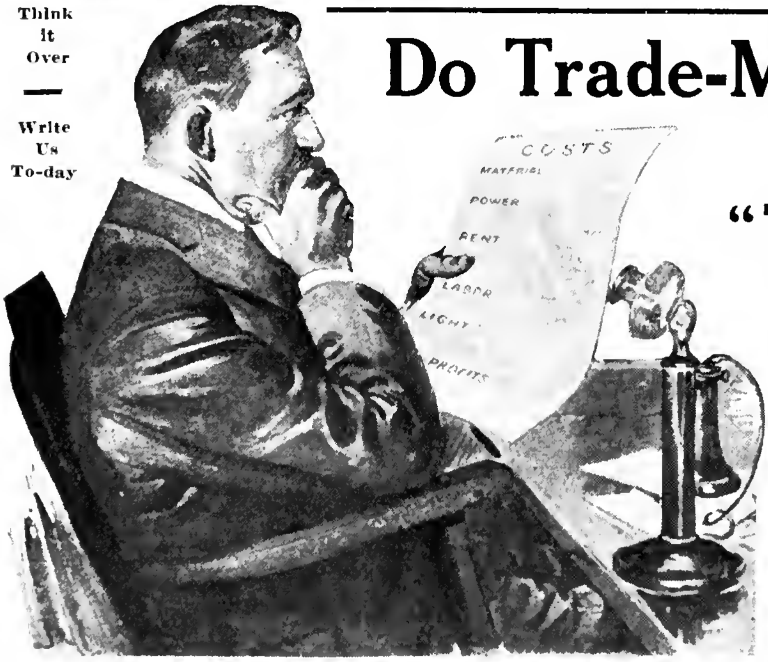

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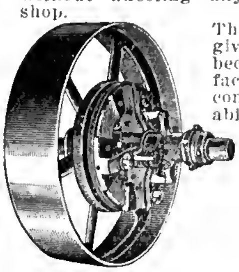

its bicycle and munition departments as heretofore, but its motor car interest will now be represented by its holdings in the new Willys-Overland, Ltd.

New Incorporations

The Hamilton Aero Mfg. Co. of Vancouver, B.C., has been incorporated with a capital of $50,000.

The Great Western Direct Power Engine Co., of Vancouver, B.C., has been incorporated with a capital of $25,000.

The Eclipse Iron Works, Ltd., Vancouver, B.C., has been incorporated with a capital stock of $20,000 to manufacture iron, steel, machinery, etc.

The International Gas Co. has been incorporated at Ottawa with a capital of $125,000. Incorporators: W. Bradley, T. A. Beament and A. H. Armstrong.

Atlantic Chemicals, Ltd., have been incorporated at Ottawa with a capital of $50,000 to manufacture chemicals and drugs at Toronto. Incorporators: Frank Regan, John G. Holmes, of Toronto, Ont.

The Castings Co. of Canada, Ltd., has been incorporated with a capital of $40,000. Head office at Montreal and works at Valleyfield, Que. Incorporators: H. Cohen, A. Ellison and S. G. Metcalfe, of Montreal.

The Canadian Lockers, Ltd., has been incorporated at Ottawa, with a capital of $100,000, to manufacture lockers, vaults, etc., at Toronto, Ont. Incorporators—H. Riley, J. W. Bicknell and J. S. Duggan, all of Toronto.

The Reliable Oil Co. has been incorporated at Ottawa with a capital of $40,000 to produce and refine oil and oil products at Montreal. Incorporators: Henry J. Trihey, Ernest Lafontaine and Michael T. Burke, all of Montreal.

Gres Falls Development Co. has been incorporated at Ottawa with a capital of $10,000 to purchase and develop water powers. Head office at Montreal. Incorporators: Gordon W. MacDougall and Lawrence McFarlane, of Montreal.

The Cheney Waterworks Co. has been incorporated at Toronto, with a capital of $1,500, to construct and operate a waterworks system at Cheney, Ont. Provisional directors—J. Limery, D. and A. Legault, of Cheney, Ont.

The Canadian Briscoe Motor Co., Ltd., has been incorporated at Ottawa with a capital of $200,000 to manufacture motor cars and trucks. Head office at Brockville, Ont. Incorporators: T. J. Storry, A. O. Heather and H. L. McDowell, all of Brockville, Ont.

The Canadian Crow Motor Co. has been incorporated at Toronto, with a capital of $100,000, to manufacture motor cars at Mount Brydges, Ont. Provisional directors are J. K. Kidd, Edward R. Bond and G. Lowthian.

The Brandon Shell Co. has been incorporated at Toronto, with a capital of $100,000, to manufacture munitions at Toronto, Ont. Incorporators—Harold W. Shapley, William B. Milliken, and Gordon McLaughlin, all of Toronto.

The Arena of London, Ltd., has been incorporated at Toronto, with a capital of $40,000, to operate an arena and manufacture ice at London, Ont. Provisional directors—W. I. Spettigue, F. B. Ashplant and E. B. Graham, all of London.

The Ideal Foundry & Hardware Co. has been incorporated at Toronto, with a capital of $50,000, to take over as a going concern the Imperial Foundry Co. of Toronto. Provisional directors—A. E. Furniss, R. M. Yeomans and B. MacDonald.

The Salt Development Co. of Canada, Ltd., has been incorporated at Ottawa with a capital of $35,000 to develop and manufacture salt and salt products. Head office at Montreal. Incorporators: Louis A. David, Louis E. A. Mailhiot and Segfried H. R. Bush, all of Montreal.

Catalogues

Sand Mixers.—The Sand Mixing Machine Co., New York, have issued a booklet containing reproductions of 30 advertisements from customers who have purchased their auto sand cutter. In addition to the above, the machine is fully described and illustrated.

"Lagonda" Valves.—The latest publication, N-3, issued by the Lagonda Mfg. Co., of Springfield, Ohio, is a 24-page bulletin on their triple-acting automatic cut-off valves and non-return valves. This book briefly, but completely, discusses the function of these valves, and illustrates the several types made by the Lagonda Mfg. Co., which are the standard angle type and straight way valve, the low squat body valve for low head room, and the horizontal valve. A copy of this bulletin will be sent to anyone on request.

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(8) Cleveland Automatic Screw Machines, with 3⅝" spindle capacity. These machines are of 1909 model. Price ($2500.00) each. F.O.B. shipping point.

TURRET LATHES.

One Jones & Lamson 2 x 24 flat turret with bar equipment, cone driven, condition first class. Price $750.00

One Garvin No. 3 turret lathe, 18" swing, with 2⅛" hole through spindle, back geared and friction head. Price $450.00

One Garvin No. 2½ turret lathe, 16" swing, 1½" hole through spindle, back geared and friction head. Price $400.00

One American Tool Works Co. turret lathe, 18" swing with 3" hole through spindle, equipped with back gear, friction head. Price.. $700.00

One Pratt & Whitney No. 3 turret lathe, 14" swing, 1¼" hole through spindle, back geared and friction head. Price.......... $390.00

One No. 3 Pratt & Whitney screw machine, 14" swing, 1" hole through spindle, with wire feed attachment, plain head. Price $325.00

One Davis & Egan No. 3 screw machine, 12" swing with 1" hole through spindle, complete with wire feed, plain head. Price $275.00

One Garvin wire feed screw machine, 12" swing with 1" wire feed capacity, plain head. Price $270.00

One Warner & Swasey plain head turret lathe, 14" swing with 1" spindle capacity. Price $225.00

One Windsor plain head turret lathe, 14" swing with 1" spindle capacity. Price $225.00

One 16" x 5' Gage Fox Monitor brass turning lathe, back gears. Price $300.00

Girard Machine and Tool Co.

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Eight Cleveland Automatic Screw Machines, with 3⅝" spindle capacity, 1909 model. First-class condition.

GIRARD MACHINE & TOOL COMPANY

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Combination Wrench

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Head, Bar and Shank One-Piece Steel Forging. Made from the best of materials. Parts interchangeable.

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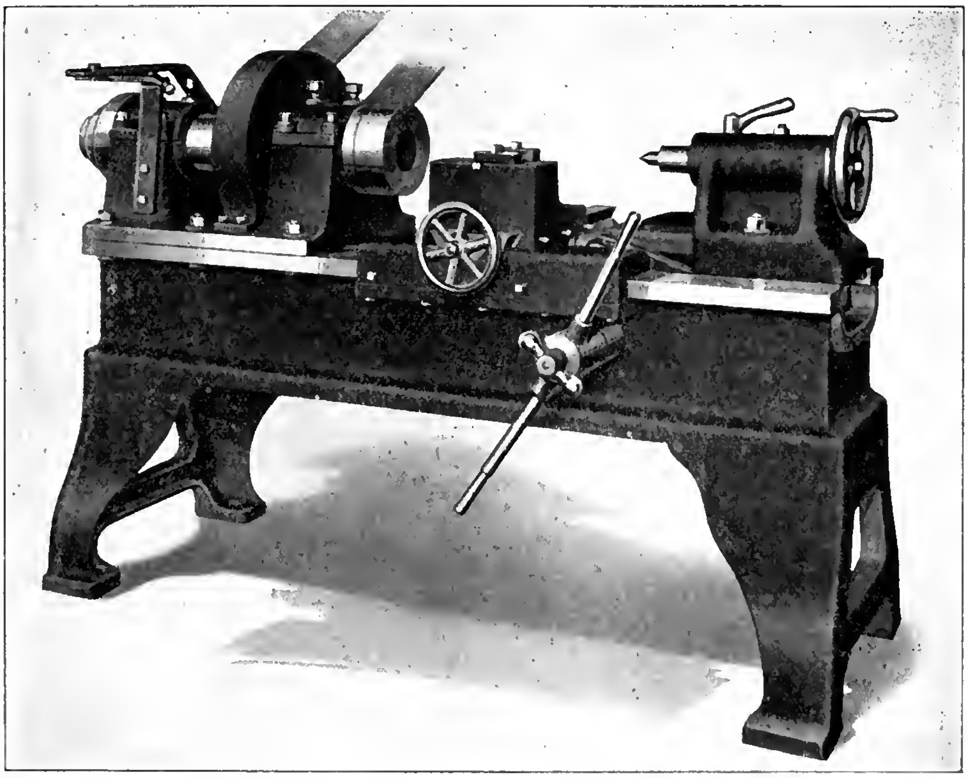

SPECIFICATIONS

Diameter of Spindle, front bearing .. 6½" x 7½"
Diameter of Spindle, back bearing .. 5¾" x 7½"
Hole through Spindle .... 3¾"
Ball thrust on front of front bearing of spindle.
Swing over Bed .... 18"
Bed 6 feet 6 in. long by 1 foot 7½" wide, flatways, giving 5⅜ in. bearings on each side.

Ratio of Gearing 5 to 1.
Travel of Tailstock Spindle .... 8"
Three Feed Speeds ....1/32", 1/16" and ⅛"
Cone Friction Drive Pulley, 13½" diam. and 8" face for driving from line shaft.
Will supply countershaft and tight pulley on lathe if desired.

The quality and service idea was built right into this lathe, which is assurance of your getting long and efficient use out of it.

Get your order in and take advantage of prompt deliveries now available.

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INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Toronto, Ont.—A new boiler will be installed at the municipal abattoir.

Petrolia, Ont.—Fred Howlett will build a brick and tile manufacturing plant.

Renfrew, Ont.—The Energite Explosives Co., of Montreal, Que., are building a plant here.

West Lorne, Ont.—The West Lorne Motors, Ltd., will shortly be in the market for new machinery.

Port Arthur, Ont.—It is reported that the Atikokan Iron Co. will equip part of their plant for making munitions.

London, Ont.—The Spray Motor Co. plans to purchase machinery for the manufacture of shells and other munitions.

Toronto, Ont.—Colonel Caldwell has informed Mayor Church that two of the boilers in the old General Hospital where the troops are stationed will have to be renewed.

Port Hope, Ont.—The Standard Ideal Co. have received from the Munitions Committee an order for 60-pdr. high explosive shells, worth over a quarter of a million dollars.

Parry Sound, Ont.—The Canadian Explosives, Ltd., will proceed at once to rebuild the section of their plant at Nobel, near here, which was recently damaged by an explosion.

Windsor, Ont.—The Ontario Cartridge Co., which is being organized, will take over the property formerly occupied by the Steel Products Co. and install machinery for making cartridges.

Collingwood, Ont.—Arrangements are being made to put the plant of the Northern Steel Co. in good repair for the manufacture of steel blanks for shells. Frank B. Baird, of Buffalo, N.Y., has concluded a satisfactory agreement with the Town Council with regard to tax assessment. The plant will be under the immediate control of William Kennedy & Sons, Owen Sound, Ont.

Electrical

Exeter, Ont.—A transformer station will be built here at a cost of $5,000.

Ridgetown, Ont.—The hydro distribution system is nearly completed, and it is expected that power will be turned on shortly.

Milverton, Ont.—It is expected that hydro will be duly installed and ready for service by Christmas. A site has been purchased west of the town for the power station.

Peterborough, Ont.—The Dickson Co. has offered the city electrical energy for the hydro-electric system at $16 per horse-power delivered here, or $13 delivered at Lakefield, where the company can develop 30,000 horse-power when the new Government dam is completed. It is stated that the Ontario Power Commission approves the price.

Municipal

Chatham, Ont.—The city council have decided to submit the Dominion Sugar Co.'s by-law on Jan. 3.

Kingston, Ont.—The city council are in the market for 500 feet of fire hose for the civic buildings.

Princeville, Ont.—The town council are considering the installation of pumps, cast iron pipe and hydrants.

Stratford, Ont.—A new water-main 1,000 feet long will probably be installed on Wellington and Britannia streets.

Galt, Ont.—The city council have agreed to permit the Galt Machine Screw Co. to build on the proposed site at Jackson Park.

Sarnia, Ont. — Sarnia City Council have decided to submit a by-law calling for the expenditure of $12,000 on the extension of the water-mains.

Cornwall, Ont.—A by-law will be voted on by the ratepayers on Jan. 1 to authorize an expenditure of $25,000 on waterworks extensions and pumping equipment.

The Pas, Man.—The town council contemplate spending $80,000 on a sewerage and waterworks system and $50,000 on the construction and equipment of an electric light system.

Newcastle, N.B.—D. A. Jackson, electrical engineer , in a report to the town council recommends the installation of a motor-driven centrifugal pump with a capacity of 350 Imperial gallons per minute. The cost of pump and motor is estimated at $2,000.

Swift Current, Sask.—A motion was unanimously passed at a council meeting recently that the city agents engage a competent engineer to make a thorough examination of the pumping and waterworks system and advise as to what will be required to bring these utilities up to adequate standard and make for a thoroughly efficient system.

General Industrial

Port Dover, Ont.—Port Dover Canning Co. will probably erect a new factory at an estimated cost of $10,000. W. Carson is the manager.

Millerton, N.B.—The New Brunswick Paper and Pulp Co. mill which was recently destroyed by fire will be rebuilt by an Anglo-American concern of which Sir Robert Perks is the main stockholder.

Building Notes

Powassan, Ont.—Contracts have been let for improvements to the Town Hall, to cost $2,710.

Long Branch, Ont.—The big new $36,000 public school is now fairly under way, excavation work going on. The building will cost $26,000, and $10,000 will be spent on the site, which covers more than two acres.

Toronto, Ont.—The Salvation Army have received a building permit for the erection of a three-storey brick and stone training home, costing $90,000, on the north side of Davisville Avenue, near Yonge Street .

Wood-Working

Rainy River, Ont.—A new industry will be established here for making boxes and shingles, etc.

Acton, Ont.—D. A. Henderson will rebuild his sawmill, which was recently destroyed by fire. Loss, $4,000.

Revelstoke, B.C.—D. W. Abrahamson's sash and door factory was destroyed by fire recently. The loss is estimated at $20,000.

Collingwood, Ont.—Wilson Bros. are asking for a loan of $35,000 from the Town Council for the purpose of extending their planing mill and developing their business. H. A. Currie is president of the company.

Tenders

St. Hyacinthe, Que.—Tenders will be received up to January 11, for a mechanical filter plant. Plans and specifications may be obtained at the office of Hector Cadieux, city engineer.

Halifax, N.S.—Tenders will be received by the Governor of the Province of Macao, up till January 8, 1916, for the supply of a steel, self-propelling dredge for the use of the Macao Harbor Works. Full particulars may be obtained at the office of Fred H. Oxley, Consul for Portugal, Keith Bldg., Halifax, N.S.

Toronto, Ont.—Tenders only for all trades required in connection with the erection of a public lavatory on Keele street will be received up to Tuesday, December 7, 1915. Plans and specifications may be seen and forms of tender and all information obtained at the office of the City Architect, City Hall, Toronto.

Halifax, N.S.—Tenders will be received by the Governor of the Province of Macao, up till January 8, 1916, for the supply of a steel, self-propelling dredge for the use of the Macao Harbor Works. Full particulars may be obtained at the office of Fred. H. Oxley, Consul for Portugal, Keith Bldg., Halifax, N.S.

St. Hyacinthe, Que.—The city council will receive tenders until January 11 for excavation, concrete work, superstructure and mechanical equipment required in the construction of a filtration plant with a capacity of 3,000,000 gallons a day. Plans and specifications can be obtained from the engineer, H. Cadieux. Estimated cost, $75,000.

Toronto, Ont.—Tenders for temporary postal station "A," Toronto, Ont., will be received until Dec. 9, 1915. Plans, specifications and form of contract can be seen and forms of tender obtained at the office of Mr. Thos. A. Hastings, Clerk of Works, Postal Station "F," Yonge Street, Toronto, Ont., and at the Department of Public Works, Ottawa.

Winnipeg, Man.—Tenders addressed to the Commissioners of the Greater Winnipeg Water District will be received up to December 15, 1915, for the supply of miscellaneous bronze castings, brass piping, etc., which enter into the construction of a Venturi meter. Specifications and form of tender may be obtained at the office of the District, 901 Boyd Bldg., Winnipeg.

Toronto, Ont.—Tenders will be received by the Chairman, Board of Control, City Hall, up to Tuesday, December 7, 1915, for the supply and erection of a mechanical mixing apparatus for the high-level chlorination plant, Wilton avenue and Don River; also the supply and erection of a mechanical mixing apparatus for the low-level chlorination plant, Eastern avenue and Don River. Specifications and forms of tender may be obtained at the Works Department, Room 6, City Hall.

Toronto, Ont.—Tenders will be received by the Chairman, Board of Control, City Hall, up to Tuesday, December 7, 1915, for the supply and erection of a mechanical mixing apparatus for the high-level chlorination plant, Wilton avenue and Don River; also the supply and erection of a mechanical mixing apparatus for the low-level chlorination plant, Eastern avenue and Don River. Specifications and forms of tender may be obtained at the Works Department, Room 6, City Hall.

Contracts Awarded

New Westminster, B.C.—The City Council has awarded a contract to Vulcan Iron Works, for riveted steel pipe, at $7,000.

Sherbrooke, Que.—The City Council have awarded the contract for gas holders for the new gas works to the Jenkes Machine Co., of this city.

Berlin, Ont.—The City Council have awarded contracts for valves to the Kerr Engine Co., Walkerville, Ont., and cast iron pipe to the Gartshore-Thompson Co., Hamilton, Ont.

Stratford, Ont.—At the meeting of the Public Utilities Commission on Nov. 22, the contract for the installation of the foundation for the new water tower was let to Everett & Marston, of this city.

Trade Gossip

Vancouver, B.C.—The Eclipse Iron Works has been incorporated for $20,000 to do a general iron manufacturing business.

The Canada Nut Co., Vancouver, B.C., has been incorporated with a capital stock of $60,000 to manufacture bolts, nuts, etc.

Quebec, Que.—The new power-house under course of construction at the Transcontinental car shops at St. Malo is nearing completion.

Wallaceburg, Ont.—It is reported that the oil refinery will commence refining about April 1 under a reorganized company. The owners, R. G. Stitt, of Toledo, and C. W. Yates, of New York, were here this week.

Owen Sound, Ont. — The Corbett Foundry and Machine Co. have secured contracts for engine lathes and thread millers, both of which are used in the manufacture of shrapnel and high-explosive shells.

Ottawa, Ont.—Ten million dollars is the capital stock of the British-Canadian Steamship Co., which has been incorporated here this week, with Montreal head office. It has secured wide powers incidental to the carrying on of a general steamship business.

The Barrie Carriage Co., Barrie, Ont., have completed arrangements with the Bell Motor Car Co., of York, Pa., and will manufacture and sell this car in Canada. The present plant will be utilized and the new department will be equipped with as little delay as possible.

The Monarch Machine Tool Co., Hamilton, Ont., have equipped a plant to manufacture lathes, thread millers, cutting-off machines, special tools and machinery for shell-making purposes. Wm. Garlock, Jr., 197 Wellesley street, Toronto, will have charge of the sales and service departments.

School of Navigation.—The second session of the School of Navigation at Queen's University, Kingston, Ont., is to open on December 14th, and continue for three months. The school will be in charge of Capt. H. M. McMaster, assistant superintendent of the Montreal Transportation Co.

Edmonds, B.C.—At a meeting of the Burnaby Board of Trade, held on Nov. 17, W. H. Mansfield, the secretary, delivered an address, advocating the wisdom and necessity of at once taking steps to push Burnaby's claims and advantages for industries. The city has a population of nearly 17,000.

Armstrong Bros. Tool Co., Chicago, Ill., announce that they have been awarded the Grand Prize for tool-holders at the Panama-Pacific Exposition at San Francisco. They were also awarded a medal of honor on other Armstrong products exhibited, including ratchets, drop-forged wrenches, clamps, lathe dogs, etc.

Brockville, Ont.—The Canadian Briscoe Motor Co., who have taken over the Dominion Carriage Co.'s factory, will extend the plant. The company is capital-

ized at $200,000 and the following officers have been appointed: T. J. Storey, president; D. M. Spaidal, vice-president; W. G. Jarman, secretary-treasurer, and and general manager: Ellery Wright, mechanical superintendent.

Vancouver, B.C.—Application is to be made by the Burrard Inlet Tunnel & Bridge Co., through their Parliamentary representatives at Ottawa, Messrs. Pringle & Guthrie, for an extension of the company's charter, which expires on the 3rd of April, next year. Owing to lack of finances, the company finds that they are unable to proceed now with the construction of the Second Narrows Bridge or the other work covered by the company's charter. Consequently an extension of time, probably five years, will be asked for.

Windsor, Ont.—A federal charter has been granted to the Pilcher Manufacturing Co., a new industry in this city. The incorporators are John Vashe Pilcher and George Pegram Walton, manufacturers, Henry Septimus Gray, capitalist, and Charles Lee Hamilton, merchant, of the city of Louisville, Kentucky; and Thomas Porter Archer, of the city of Windsor. The capital stock is $550,000.

Toronto, Ont.—Sir Adam Beck wants the city to submit a by-law to the people on January 1, authorizing an expenditure of $3,000,000 for Hydro radials. The Chairman of the Provincial Hydro Commission declared: "We are up to Toronto on the east with the vote on these radials and we are now coming after them on the west. We can do nothing else until Toronto moves, and I think that the by-law authorizing an expenditure of $3,000,000 for Hydro radials should be submitted as soon as possible." Sir Adam explained that it did not necessarily mean the immediate expenditure of $3,000,000, but the feelings of the people should be sounded, so that their position could be understood.

Toronto Transportation Club held their annual dinner at the Carls-Rite Hotel last Monday evening. The following officers were elected for the ensuing year: President, M. G. Murphy, C.P.R.; Vice-Presidents: Thos. Marshall, Board of Trade; C. E. Horning, D.P.A., G.T.R.; Secretary, W. A. Gray, D.L. & W. Ry; Treasurer, Murdo Macdonald, Grand Trunk Railway; Executive: John Gray, M. H. Brown, B. H. Bennett, D. O. Wood, John Jolly, W. J. Moffat, H. E. Watkins, W. Fulton, J. Stewart, C. B. Brodie, John Thomson. Committee Chairmen: Entertainment, F. V. Higginbottom, C.N.R.; Membership, W. McIlroy, C.P.R.; Sick, John M. Copeland, Chicago & North Western Railway.

Hydro Development is Being Advanced.—Progress is being made by Sir

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Orders must be to hand before Dec. 15.

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WOOD SCREW MACHINES

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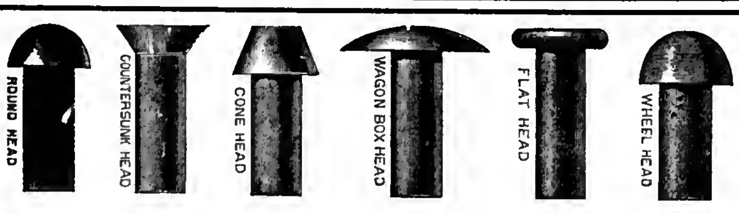
Asa S. Cook Co.

Hartford, Conn.



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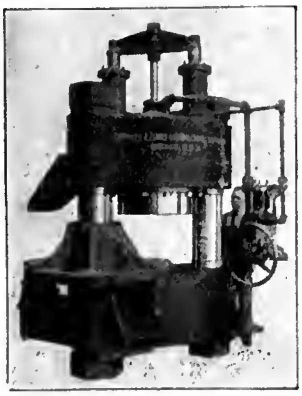

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Over 50 years' experience building hydraulic machinery.

Adam Beck in impressing upon the Ontario Government the importance and necessity of new power development. The Cabinet has had the plans and estimates of the Hydro Commission before it for nearly two months past, but the size of the project has made many conferences necessary between the Ministers and the chairman and his engineers. The new development, which, as Sir Adam Beck announced some time ago, will utilize the overflow of the Welland Canal, will, at the outset, be composed of two units of 50,000 h.p. each. By the time they are ready the consumption of power by the Hydro System will, it is expected, be sufficient to immediately give business to both units. The plans provide for utilizing the Chippewa Creek and carrying the water by an open canal across country to a point below the Whirlpool.

Personal

Gladstone Whitelaw, supt. of the Oxford Foundry, Woodstock, Ont., died on Nov. 29.

George Goodwin, at one time a prominent contractor, died at Ottawa on Nov. 28, aged 72 years.

W. J. McCully has been elected president of the Stratford Board of Trade for the ensuing year. J. Stevenson is secretary.

W. J. Tubman has succeeded James Preston as factory superintendent of the Canadian Allis-Chalmers, Ltd., at Stratford, Ont.

Frank Doty of the Doty Engine Works, Goderich, Ont., has joined the Field Artillery, and is now in camp at Guelph, Ont.

Joseph Harper Harrison, one of the oldest paper box makers in Toronto, died last Saturday night. Deceased was born in Manchester, Eng., in 1849, and came to Toronto at the age of 22.

Capt. W. Murchison, one of the veteran masters of Lake Ontario and Toronto harbor, died on Friday last. Capt. Murchison, who was born in Toronto 65 years ago, sailed on the lakes for over forty years.

Catalogues

Automatic Die-Head made by the Eastern Machine Screw Corporation, New Haven, Conn., is described and illustrated in a bulletin recently issued. The construction of the "H. & G." automatic self-opening die-head is fully dealt with and the various parts illustrated and listed.

Foundry Torch.—Two bulletins issued by the Mahr Manufacturing Co.,

Minneapolis, Minn., describe and illustrate the "Mahr" patent portable foundry torch. The illustrations show the torch being used on various classes of work in the foundry and demonstrate the utility of this appliance.

Barometric Condensers.—Bulletin R., issued by the Mesta Machine Co., Pittsburgh, Pa., illustrates and describes the "Mesta" barometric condenser for steam power plants. The principal features of this type of condenser are dealt with at length, while in addition the bulletin contains a description of the "Mesta" dry air pump.

Moulding Machines.—The catalogue edition of "The Merry Moulder" for September is devoted entirely to a review of the various types of moulding machines made by the Osborn Manufacturing Co., Cleveland, O. A number of excellent illustrations show the various types, and the methods of operation are described, accompanied by the principal dimensions for each size of machine.

"Lagonda" Valves.—The latest publication, N-3, issued by the Lagonda Mfg. Co., of Springfield, Ohio, is a 24-page bulletin on their triple-acting automatic cut-off valves and non-return valves. This book briefly, but completely, discusses the function of these valves, and illustrates the several types made by the Lagonda Mfg. Co., which are the standard angle type and straight way valve, the low squat body valve for low head room, and the horizontal valve. A copy of this bulletin will be sent to any-copy of this bulletin will be sent to interested readers on application.

Book Reviews

Report of the Selby Smelter Commission, by J. A. Holmes, E. C. Franklin, and R. A. Gould. 1915. 528 pp., 41 pls., 14 figs. One volume. Paper covers. $1.25. This No. 98 bulletin describes in detail the methods used, some of them new, in determining the contamination of the air and the damage to trees, crops, and live stock by the smoke and fume from the Selby Smelter, in California, and gives the conclusions of the commission on the methods used by the smelter company to prevent injury. The bulletin is of especial interest to metallurgical companies, municipal or State boards of health, and persons investigating damage by smelter smoke. Owing to the expense involved in the preparation and publication of this bulletin and the limited printing funds available for the use of the Bureau of Mines, it has been necessary to place a price of $1.25 on the work. Orders should not be sent to the Bureau of Mines, but should be addressed to the Superintendent of Documents, Government Printing Office, Washington, D.C.

Trade Gossip

Eden, Ont.—E. Ketchalaw is in the market for woodworking machinery.

London, Ont.—The George H. Beton Lumber Co. will install electrical equipment in its plant to operate woodworking machinery.

Oakville, Ont.—The W. H. Carson brick, sash and door factory on Dundas street, north of Colborne street, was damaged by fire last Saturday to the extent of $10,000.

The Imperial Oil Co., Sarnia, Ont., will increase their capital stock to $50,000,000, to take care of any future possible growth of business. Walter C. Teagle is chairman of directors.

The Imperial Munitions Board have accepted the process of sherardizing cast iron nose plugs for shells as an alternative to nickel-plating. Brass plugs are now being replaced with cast iron ones.

Demand for Old Rails.—With reference to an item regarding the demand for old rails which appeared in the Dec. 2 issue of **Canadian Machinery,** a correspondent advises us that he has a considerable quantity of this material in stock and would like to be put in touch with prospective consumers.

The Canadian Poreclain Co., Hamilton, Ont., have presented to the Hamilton Technical School a fine collection of porcelain insulators used on high tension transmission lines, ranging in voltage from 2,000 to 150,000. The collection will be found valuable in the electrical department of the school for construction in high tension work.

The Canadian Association of Boat Manufacturers at a meeting held in Toronto, elected the following officers:—Hugh Warnock, Penetang, president; M. L. Butler, Brighton, 1st vice-president; W. R. Richardson, of Peterboro', 2nd vice-president; A. F. Fenton, Toronto, secretary; and Herbert Ditchburn, Gravenhurst, treasurer, succeeding Capt. C. H. Rogers, of Peterboro', who is now in France.

Tungsten Advancing. — Prices of tungsten ore and tungsten metal continue to soar. A recent sale of high-grade tungsten ore in the States is noted at $45 per unit for 60 per cent. ore. In September $32 per unit was paid, and in August $16. Tungsten metal or ferro-tungsten is now selling at about $6 per pound of contained tungsten as against 60 cents to 65 cents before the war, and $2.50 a few months ago.

The Steel Company of Canada, Hamilton, Ont., as a result of its increasing business, largely due to the big war orders it has received and the prospect for business after peace is arranged, is planning extensive additions to its plant. Three new open-hearth furnaces are to be built at once, the blooming mill extended and two forge plants erected for the manufacture of 8 and 9.2 shells. The improvement will cost several hundred thousands of dollars.

French Industrial Commission.—Members of the French industrial and Commercial Commission, which recently arrived in New York to promote trade relations between the United States and France following the war, have arranged a tentative itinerary for the next few weeks that will take them to a number of leading cities of the United States and Canada. About Dec. 15 they have arranged to come to Canada for a stay of a week or ten days.

Toronto, Ont.—A by-law seeking permission to guarantee $3,000,000 of debentures as the city's investment in the proposed hydro-electric radial scheme will be submitted to the ratepayers on January 1st next. This decision was arrived at by the Board of Control after conferring with Sir Adam Beck, chairman of the Provincial Hydro-electric Commission, and his chief engineer, F. A. Gaby, on Dec. 1. This amount does not cover the terminals to be located in the city or that part of those radials which constitute a portion of the city's rapid transit. In short the citizens will be asked to meet the cost of all rapid transit lines within the city limits and invest the suggested $3,000,000 in the general scheming outside the city.

Tenders

St. Hyacinthe, Que.—Tenders will be received up to January 11, for a mechanical filter plant. Plans and specifications may be obtained at the office of Hector Cadieux, city engineer.

Halifax, N.S.—Tenders will be received by the Governor of the Province of Macao, up till January 8, 1916, for the supply of a steel, self-propelling dredge for the use of the Macao Harbor Works. Full particulars may be obtained at the office of Fred H. Oxley, Consul for Portugal, Keith Bldg., Halifax, N.S.

Winnipeg, Man. — Tenders addressed to the Commissioners of the Greater Winnipeg Water District will be received up to December 15, 1915, for the supply of miscellaneous bronze castings, brass piping, etc., which enter into the construction of a Venturi meter. Specifications and form of tender may be obtained at the office of the District, 901 Boyd Bldg., Winnipeg.

Personal

John Milne, president of the Burrow, Stewart & Milne Co., Hamilton, Ont., has been appointed to the Senate.

John Ansley, at one time county engineer and also proprietor of the local iron foundry, died at Wingham, Ont., on Nov. 28, aged 83.

P. E. Mercier, acting chief engineer for the City of Montreal, will probably be appointed to that position in succession to the late Georges Janin.

C. L. Jobb, general manager of the Canadian Iron Corporation, has been in Fort William, Ont., for a few days on business connected with the local plant.

Abraham Van Winkle, of the Hanson & Van Winkle Co., died at Newark, N. J., recently aged 77. Mr. Van Winkle, who was born at Pompton, N.J., assisted in the development of the first low voltage dynamo made in the United States.

Charlton James Wollaston, a pioneer in submarine telegraphy, and who laid the first cable from Dover to Cape Gris-Nez, the nearest point on the French shore to that of Britain, died recently in England.

Railways—Bridges

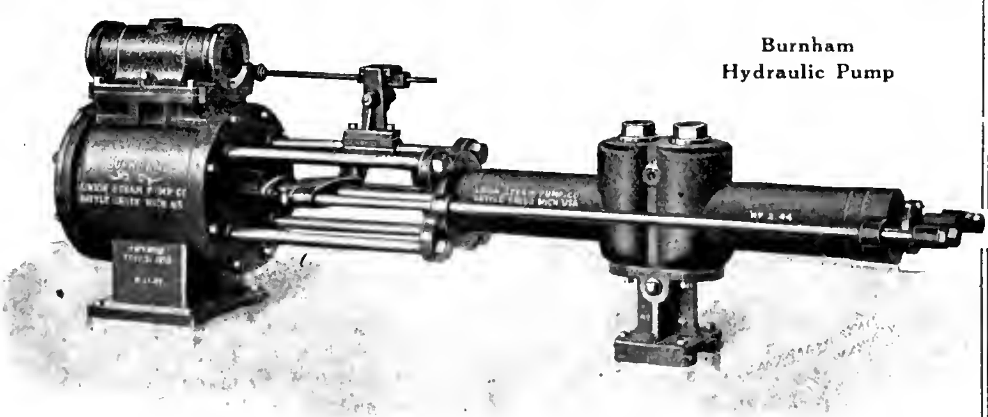
London, Ont.—The council have decided to submit the by-law requested by the London & Port Stanley Railway to raise $101,000 for track extensions.

Brantford, Ont.—At a special meeting of council, it was decided to give ratepayers of the city a chance to vote on ratification of the sale of the Grand Valley Railway between Paris and Galt to the Lake Erie and Northern Railway, which railway is controlled by the C. P.R. between Galt and Port Dover. The cost will be $30,000, and electrification of L. E. and N. Railway from Galt to Port Dover.

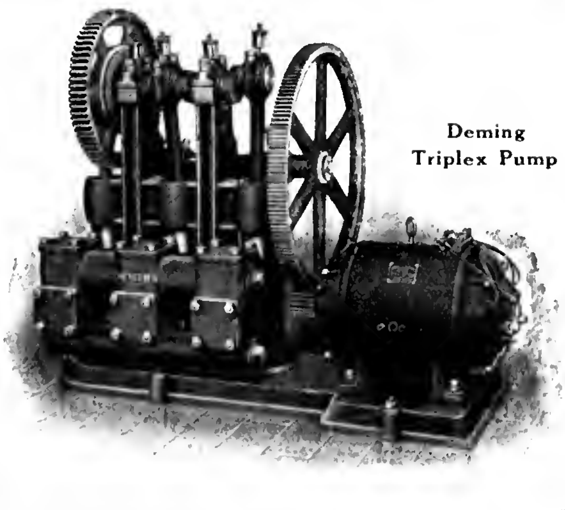
London, Ont.—The first step toward the million-dollar guarantee of bonds for the proposed Hydro-radial railway was taken last Monday by the city council, which gave two readings to the by-law and sent it on to the ratepayers.

Hydro Radials.—This proposed Hydro radial scheme includes projected lines running from Western Ontario via London and Guelph, Hamilton to Toronto, Barrie to Toronto, the proposed Markham and Uxbridge line and that section suggested for the connection of Port Perry with Toronto via Whitby. Sir Adam's Beck idea is to make Toronto the real pivotal point of all the adjacent counties, and latterly, the Province for

Pumps for SHELL MAKERS



Burnham Hydraulic Pump



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farming, market gardening and other industries, as well as for passenger traffic.

Radial Plans Approved.—The Toronto-Guelph-Berlin-London Hydro Radial project was further advanced on Nov. 23 when a deputation of municipal representatives from Mimico and New Toronto discussed with Chief Engineer Gaby, of the Provincial Hydro-Electric Commission, at Toronto, route plans and other points in connection with the line. This conference was one of a number the commission's engineers are having with the representatives of the various municipalities interested in order to secure approval of plans and details.

New Incorporations

The Eclipse Iron Works, Ltd., of Vancouver, B.C., has been incorporated with a capital of $20,000.

The Eastern Machinery Co. of Montreal has been incorporated with a capital of $45,000. Incorporators: A. Lalonde, E. A. Lalonde and D. L. Desbois, all of Montreal.

The Dominion Shell Mfg. Co. of Montreal has been incorporated with a capital of $99,000. Incorporators: H. C. Thorn, L. H. Cote and W. W. Laindon, all of Montreal.

The Dominion Magnesite Co. of Calumet, Que., has been incorporated with a capital of $100,000. Incorporators: F. G. Bush, G. R. Drennan and M. J. O'Brien, all of Montreal.

The Lachance Nut Lock Co. has been incorporated with a capital of $300,000 to carry on business at Montreal, Que. Incorporators, J. A. Bilodeau, M. Loranger and B. Melaveon, of Montreal.

The Kirkland Lake Gold Mining Co. has been incorporated at Toronto, with a capital of $2,000,000, to acquire and develop mineral lands and deposits. Head office at Toronto. Incorporators—David Inglis Grant and Gideon Grant, of Toronto.

The Triumph Mines, Ltd., has been incorporated at Toronto, with a capital of $3,000,000, to acquire and develop mineral lands and deposits. Head office at Toronto. Incorporators—James Richardson Roaf and John Edward Morden, of Toronto.

The Canadian Vincent Valve Co. has been incorporated at Ottawa with a capital of $25,000 to manufacture the Vincent drain valve and similar appliances at Victoria, B.C. Incorporators: Arthur Newham, R. Powell and E. Bonner, all of Victoria, B.C.

The Alliance Beverage Co. of Toronto has been incorporated at Toronto, with a capital of $40,000, to manufacture beverages, condiments, preserves, etc., at Toronto. Incorporators—Henry Cresser Haskins and Edward Gowan Russell Aradagh, of Toronto, Ont.

The Federal Brass Co. has been incorporated at Ottawa with a capital of $50,000 to acquire the business now carried on by the Federal Electric & Mfg. Co. at Montreal. Incorporators: Joseph Phillipe Arthur Belanger and Louis Joseph Cyprien Gagnon of Montreal.

The Canadian Brass Bedsteads, Ltd., has been incorporated at Ottawa with a capital of $45,000 to manufacture household furniture of all kinds and in particular brass and iron bedsteads, at Montreal. Incorporators: Eugene Honore Godin and Joseph Eudore Morier, of Montreal.

Canadian Canners, Ltd., has been incorporated at Ottawa with a capital of $1,000,000 to carry on business as manufacturers of all kinds of canned goods, condiments, pickles, etc., at Toronto, Ont. Incorporators: John Dawson Montgomery, Arthur Carson McMaster, of Toronto.

The Pilcher Mfg. Co. has been incorporated at Ottawa with a capital of $50,000 to manufacture metal buttons and other goods, at Windsor, Ont. Incorporators: John Vashe Pilcher and George Pegram Walton, of Louisville, Kentucky, and Thomas P. Archer, of Windsor, Ont.

The Canadian Electro Products Co. has been incorporated at Ottawa with a capital of $500,000 to manufacture all kinds of metals, metallic substances, metallic products, chemicals, etc., at Montreal. Incorporators: Walter Robert Lorimer Banks and Daniel Percy Gillmor of Montreal.

The Western Sugar Refining Co. has been incorporated at Toronto, with a capital of $600,000, to manufacture, refine sugar and by-products at Petrolia, Ont. Incorporators: Ralph Daniel Mitchell and Daniel Joseph Kilby, of Cleveland, Ohio, and David A. Gordon, of Wallaceburg, Ont.

The Imperial Cordage Co. has been incorporated at Ottawa with a capital of $150,000 to manufacture rope, binder twine, and all products and by-products of manila, hemp and sisal, at Walkerton, Ont. Incorporators: John Connor, of St. John, N.B., E. A. D. Morgan and S. Avery of Montreal, Que.

Contracts Awarded

Toronto, Ont.—The city council have awarded a contract, lead-covered underground cable, to the E. F. Philips Electrical Works, Ltd., Montreal.

Kingston, Ont.—The City Council have awarded a contract for rubber lined linen fire hose to the Goodyear Tire & Rubber Co., Toronto, at 50c per foot.

Merrickville, Ont.—The Rideau Power Co., have awarded contracts for water wheels to the William Hamilton Co., Peterborough, and electrical equipment to the Swedish General Electric Co. The total cost of power house and plant is estimated at $80,000.

Catalogues

Oiling Devices made by the Canadian Winkley Co., Windsor, Ont., are the subject of catalogue No. 10. A large number of styles are illustrated and described in detail, accompanied by price list and principal dimensions for each size.

The Canadian General Electric Co., Toronto, Ont., have issued a bulletin illustrating and describing a new multi-stage centrifugal compressor set No. 3350. This machine is particularly applicable for use in connection with oil or gas-burning furnaces and a list of operating advantages is given.

Buffing and Polishing Machinery.—Bulletin No. 700 on buffing, polishing and burnishing machinery, the latest of the series of "Munning-Loeb" publications on electro-plating and polishing equipment and supplies, fully describes the Munning-Loeb line of buffing and polishing lathes from the small bench lathes to the large double-spindle pedestal lathe, also belt strapping machines, flexible grinders, tumbling barrels, burnishing barrels and sand blast apparatus. This bulletin will be sent to anyone on request.

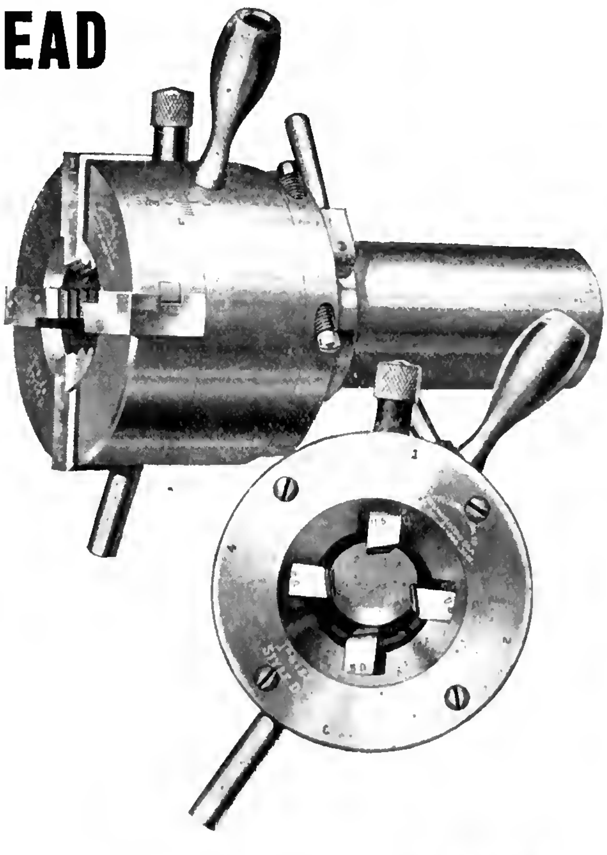
Motor Generator Sets.—Bulletin No. 42,552 issued by the Canadian General Electric Co., Toronto, illustrates and describes an interesting and varied range of motor generator sets adapted for different purposes. The bulletin contains a considerable amount of information covering the operation, field of application, excitation and construction of motor generators, while booster and balancer sets are also dealt with. The bulletin contains a number of excellent halftones covering the various types and showing in a general way the design and arrangement when installed.

Lubricators.—Bulletin No. 60, the Richardson model "M" sight feed oil pump recently issued by the Richardson-Phenix Co. of Milwaukee, Wis., contains much new information concerning the

well-known model "M" lubricator. Interesting illustrations show the process of manufacture from the raw material to the finished lubricators on the test rack, and give a good idea of the manner in which the pumps are drilled and milled from a solid block of cast iron. An interesting chapter on gas engine lubrication discusses the question of timing the admission of oil so that it is forced directly on to the engine pistons. Other items of interest are a description of the new Richardson air spray attachment; also the steam and electric attachments for heating the oil in the lubricator reservoir. A double-page illustration of the New York sky-line shows that practically all important buildings in the Metropolitan district are equipped with Richardson-Phenix lubricating appliances. Copies of the above bulletin may be had upon request from the company.

Book Reviews

The Model T Ford Car, its construction, operation and repair, by Victor W. Page, 300 pages, 5 x 7, 100 engravings and two folding plates. Published by the Norman W. Henley Publishing Co., New York City. Price $1. This is the 1916 edition of a book which, as the title indicates, is written chiefly for owners, dealers and salesmen of Ford cars. Although the book deals exclusively with one particular make of car, the fact that so many Ford cars are in operation makes the situation somewhat exceptional, and warrants the publication of a special treatise on its repair and maintenance, especially as so many owners of Ford cars possess but little mechanical knowledge. The volume as a practical instruction book is complete and the subject is treated in a comprehensive manner. The construction is fully described and the operative principles made clear to everyone. Complete instructions for driving and repairing are given, while every phase of the subject is treated in a non-technical manner. The book contains five chapters. The first deals with the Ford car with regard to its parts and their functions. Chapter 2 describes the engine and the various auxiliary groups. The details of the Ford chassis parts are dealt with in chapter 3, while chapter 4 contains instructions for driving and the maintenance of the car. The concluding chapter on overhauling and repairing the mechanism is of special value and contains a great deal of valuable information. The diagrams and half-tones, which are full of detail, have been carefully prepared and are very instructive. The book is fully indexed, printed in clear type, and is bound in cloth.



company who propose establishing a plant to manufacture wood alcohol, charcoal and acetic acid. Thomas Hodgson is promoting the company.

Toronto, Ont.—Parks Commissioner Chambers has recommended to Board of Control that three stand-pipes, the necessary quantity of fire hose, and three portable extinguishers be installed at the Process Building at the Exhibition grounds, where the soldiers are accommodated. The cost of the equipment will be $255.

Petrolea, Ont.—The council on Dec. 7 gave first and second readings to the by-law for $21,500 to assist the Western Sugar Refining Co., which will locate here, if this inducement is granted. A by-law to raise $25,000 to purchase stock in the company was twice read. These issues will be voted upon by the ratepayers January 3.

Electrical

St. Thomas, Ont.—The Michigan Central Railway will electrify their terminal at this place.

Hull, Que.—The city council are considering extensions to the lighting system, estimated to cost $20,000.

Biddulph Township, Ont.—A by-law has been passed providing for the installation of a hydro-electric system at an approximate cost of $3,500.

Burgessville, Ont.—A by-law to provide for the construction of a hydro-electric system at an approximate cost of $3,500 will shortly be submitted by the township council of South Norwich.

General Industrial

St. Catharines, Ont.—Fire on Dec. 7 destroyed the Maple Leaf Milling Co.'s flour mill here. The loss is estimated at $75,000, which is fully covered by insurance.

Davidson, Sask.—The Canadian Elevator Co. will build an extension to their elevator. The North Star Elevator Co. and the British American Elevator Co. will also enlarge their mills.

Vancouver, B.C.—The Canada Potash and Algin Co. will shortly work on a new plant for making iodine and gum algin. These materials will be made from kelp, which is found in large quantities along the coast.

Sackville, N.B.—The A. E. Wry Standard, Ltd., factory was damaged by fire on December 5, the loss being estimated at $35,000, of which $20,000 is covered by insurance. The company manufacture harness and other leather goods.

Toronto, Ont.——The factory of T. Crowley & Co., manufacturers of picture frames, on McDonnell Square, was badly damaged by fire on Dec. 12. The damage is placed at about $1,500 to the building and $7,000 to the stock and contents. The loss is covered by insurance.

Contracts Awarded

The Otis-Fensom Co., Hamilton, Ont., have been awarded a contract for an elevator by the Patterson Mfg. Co., of Montreal, Que.

Port Moody, B.C.—The contract for the construction of a waterworks system has been awarded to the Robertson-Godson Co., Vancouver, B.C., at $37,000.

Toronto, Ont.—The Board of Control has awarded a contract for the supply and installation of valves, steam piping, special steel castings and lagging at main pumping station to Purdy, Mansell, Ltd., at $19,995.

Brockville, Ont.—The Public Utilities Commission at a meeting on Dec. 7 awarded the contract for the new filtration plant to the Roberts Filtration Company, of Darby, Pa., for $86,000, and also requested the Town Council to provide $115,000 to cover the filtration plant, low lift pumps and intake cost.

Tenders

St. Hyacinthe, Que.—Tenders will be received up to January 11, for a mechanical filter plant. Plans and specifications may be obtained at the office of Hector Cadieux, city engineer.

Halifax, N. S.—Tenders will be received by the Governor of the Province of Macao, up till January 8, 1916, for the supply of a steel, self-propelling dredge for the use of the Macao Harbor Works. Full particulars may be obtained at the office of Fred H. Oxley, Consul for Portugal, Keith Bldg., Halifax, N.S.

Winnipeg, Man.—Tenders will be received up to Monday, December 27, 1915, for the supply of one saddle tank locomotive to the Greater Winnipeg Water Commission. Specifications and form of tender may be obtained and contract may be inspected at the offices of the district, 901 Boyd Building, Winnipeg, Man.

Winnipeg, Man.—Tenders addressed to the undersigned will be received up to Wednesday, December 29, 1915, for the supply of twenty twenty-yard automatic air-dump cars. Specifications and form of tender may be obtained and form of contract may be inspected at the office of the district. S. H. Reynolds, Chairman of the Greater Winnipeg Water Commissioners, 901 Boyd Building, Winnipeg, Man.

Trade Gossip

The Shawinigan Electro Metals Co. have increased the capital stock of the concern to $200,000.

The International Steel Corporation, Ltd, have changed the name of the concern to Canadian Iron Ores, Ltd.

The Turnbull Elevator Co., Toronto, have been awarded a contract for the elevators for the Crompton Corset Co.'s new warehouse.

Simcoe, Ont—The Town Council will submit a by-law for the establishment of a Utilities Commission to take over the waterworks sewage disposal plant and the hydro system.

The Canada Steamship Line, Montreal staff have enlisted for overseas service. The eligible men are to be enlisted in one battalion, and officers, who are to go to Halifax at once to qualify for commissions, will lead the company. There are forty-six Canada Steamship Line in the trenches now.

Kingston, Ont.—The announcement of United States Consul F. F. Johnson last Monday shows the export trade from this port to the States for the year 1915 to have reached the million dollar mark, giving Kingston third place in the Dominion, with Toronto first and Ottawa second.

Toronto, Ont.—It is reported from La Porte, Ind., that the plants of the M. Rumley Co., and Rumley Products Co., capitalized at $32,000,000, were bought in at receiver's sale for $4,000,000 on Dec. 9 by reorganized Rumley companies. The Rumley Co. have a branch in this city.

Toronto, Ont.—Roads to the extent of 250 miles have been permanently improved and macadamized in various parts of the Province of Ontario this year. On colonization roads $220,078.19 has been spent. The total cost of the Hamilton-Toronto highway will be about $900,000. The estimated cost was $600,000.

Montreal, Que.—The shareholders of the Canada Cement Company, at a special meeting recently unanimously authorized an application for supplementary letters patent permitting the company to embark on the manufacture of war munitions. General Manager Jones gave an optimistic forecast of the results expected from the business, and the shareholders were informed that no new financing would be necessary.

Montreal, Que.—Three departments of the Grand Trunk Railway shops at Point St. Charles were gutted by fire which broke out at noon on Dec. 10 in the tube

shop and spread to the blacksmith shop and the erecting plant. The fire was caused by a tube striking and breaking an oil pipe, the oil igniting and flowing in all directions. The tube shop, blacksmith shop and part of the erecting shop were destroyed.

Toronto Harbor Works.—It is announced that the Toronto harbor work in the vicinity of Cherry Street is to proceed as weather permits. The Canadian Stewart Co., the contractors, have undertaken to make good the defective construction by a sub-contractor disclosed upon examination by Government experts, and the work will proceed without further hitch in favorable weather. The restoration of the imperfect construction will be done without cost to the Government, it is said. The contractors say there will be no unnecessary delay.

Grain Moving on N. T. R.—Arrangements have now been completed for the official inspection, weighing and grading of grain at Winnipeg so that grain consigned by the N. T. R. will not have to go first to Fort William or Port Arthur. At present all certificates are granted at the head of the lakes. At Halifax, where most of the grain handled will be shipped, Mr. Cochrane has made arrangements for the storage of some five hundred cars, so that the grain will be protected until shipped. There is no elevator accommodation at Halifax. The Government expects to get a large share of the winter all-rail shipments.

National Steel Car Co.—In a letter to the shareholders, Vice-President Basil Magor states that the company has orders aggregating $8,000,000 for rolling stock to be used on foreign railways, as well as other large contracts, and in addition the company is building steel sleeping coaches, first-class coaches and motor trucks. Mr. Magor states that the fiscal year ending on November 30 will show approximately $450,000 of profits, and that, therefore, if the dividend liability is removed without depleting too much the working capital, the company's position will be substantially improved.

Personal

Frederick Powell, president of the Rideau Lumber Co., Ottawa, Ont., died on December 3.

W. G. Worden, a graduate of Toronto University, has been appointed town engineer of Oshawa, Ont., to succeed F. A. Chappell, who has resigned.

E. M. Smith, president of the American Shipbuilding Co., who owns the dry dock at Port Arthur, Ont., died suddenly at Buffalo, N.Y., on Dec. 8.

A. G. McAvity, manager of the Canadian Blower & Forge Co., Berlin, Ont., has been engaged by the Imperial Munitions Board in an advisory capacity.

Lieut. F. Y. Harcourt, who for several years has been district harbor engineer at Port Arthur, Ont., has received a commission in the 94th Battalion of the C.E.F.

W. L. Helliwell, manager of the Gurney Northwest Foundry Co., Winnipeg, Man., has been appointed to a more important position on the staff of the firm at the head office in Montreal.

Thomas J .Walsh, chief operating engineer of the high-level pumping station, Toronto, Ont., who had been in the civic service for a long number of years, died on Dec. 12 at his home, 40 Rathnally Avenue, in his 55th year.

H .S. Carmichatel has been appointed freight and passenger agent at London, England, of the Canadian Pacific Ocean Services. He completes twenty years' service with the C. P. R. this week. H. S. Dring succeeds him as passenger agent of the C. P. R.

L. C. Ord, assistant works manager, Angus car shops, C. P. R., Montreal, Que., has been appointed Lieutenant in No. 1 Overseas Battery of the Siege Artillery, C.E.F., and has been granted leave of absence for active service. Lieutenant Ord sailed from Halifax for the front November 22nd.

F. Perry has been appointed a member of the Imperial Munitions Board. Mr. Perry has for some years represented in Canada a large private banking house of London. At one time he was attached to the British Colonial Office, and later was Imperial secretary to Lord Milner in South Africa and chairman of a native labor association in South Africa.

New Incorporations

The York Paper Box Co. has been incorporated at Toronto, with a capital of $40,000, to manufacture all kinds of paper boxes, etc., at Toronto. Incorporators: James Douglas Woods and William Batten McPherson, of Toronto.

The Chemical Refinery, Ltd., has been incorporated at Ottawa, with a capital of $100,000, to manufacture drugs, chemicals and fertilizers at St. Catharines, Ont. Incorporators: John P. Mitchell, Harry W. Page and W. P. Crow, all of Toronto.

The J. S. Lewis & Sons, Ltd., has been incorporated at Ottawa, with a capital of $100,000, to carry on the business of lumbering and manufacturing of wood and other materials at Truro, N.S. Incorporators: George Ezra Morton Lewis and Frank Leslie Lewis, of Truro, N.S.

Railways—Bridges

Brantford, Ont.—It is understood that arrangements are practically completed for the creation of a Union Radial Station in this city to be used jointly by the Brantford and Hamilton and Lake Erie and Northern Railways. The intention is to place it on the old site of the Brantford Ice Co., and it will cost approximately $30,000.

Berlin, Ont.—By a vote of eight to four the City Council decided on Dec. 6 to submit a hydro-radial by-law for $779,000 to the ratepayers. Waterloo Town and Waterloo Township Councils also voted in favor of submitting similar by-laws, the former for $193,000, and the latter for $521,903. Engineer F. A. Gaby, of the Ontario Hydro-Electric Commission, attended all three meetings. The route through Berlin agreed upon by the citizens was not defined in the by-law.

Building Notes

Toronto, Ont.—A building permit has been issued to W. H. Harris, in trust, for the erection of a two-storey brick mill construction warehouse on the north side of Richmond Street, near John Street, costing $18,000.

Wood-Working

Calgary, Alta.—The Rumley Co. propose building a warehouse here and make the city a distributing centre.

Hamilton, Ont.—Spontaneous combustion started a blaze in the Semmens & Evel casket factory on December 7, and did $2,000 damage.

Deseronto, Ont.—The Canada Hardwood Mfg. Co. is in the market for sawmill and wood-working machinery, automatic lathes, belting, etc.

Marine

Port Arthur, Ont.—The Western Dry Dock & Shipbuilding Co.'s plant will be working to capacity during the coming winter months. The company have on hand several freighters for lake service.

Port Arthur, Ont.—Freight rates from Port Arthur to Buffalo have risen from a rate of from three and a half to four cents a bushel, which prevailed during the regular season, to five and a half cents.

North Vancouver, B.C.—The City Council will immediately take steps to offer some inducements for the establishment of a drydock on the North Shore. The Board of Trade will support the scheme.

John L. Nelson, who came to the Province of British Columbia in March, 1913, as superintendent of dredging, has sent in his resignation to the Department of Public Works.

Port Arthur, Ont.—The Canadian steamer, W. Grant Morden, the longest boat on the lakes, left on Dec. 9 for Port McNicoll with 760,000 bushels of oats, the largest cargo ever taken from this port, being equivalent to 400 loaded cars.

Brockville, Ont.—The Department of Marine and Fisheries has awarded the contract for the erection of a lighthouse one the river front at Fulford's Point, west of here. The building will be twenty feet high with concrete foundation.

Collingwood, Ont.—The steamer Hamonie of the Northern Navigation Co.'s Lake Superior fleet is coming to Collingwood about Dec. 15th and will probably remain throughout the winter. The object of the visit is to go to the dry dock for repairs.

Catalogues

Milling Machines.—A bulletin issued by the Fox Machine Co., Grand Rapids, Mich., describes and illustrates the "Fox" No. 3 hand and power feed milling machine. A specification is included giving the principal dimensions and shipping weights, etc.

Air Heater and Air Blower.—Bulletin No. 219, issued by the B. F. Sturtevant Co., Boston, Mass., deals with the "Sturtevant" electric air heater and blower. The apparatus is fully described and the various purposes for which it can be used are given in detail. A list of sizes with capacities is included and the illustrations show a few different types indicating their varied application.

Friction Clutches made by the Carlyle, Johnson Machine Co., Manchester, Conn., are illustrated and described in catalogue E, recently issued. The various classes of work for which this clutch is suitable are described separately with illustrations showing the mountings. Tables are included giving the principal dimensions, accompanied by diagrams showing to what part the dimensions refer. Other equipment for use with these clutches is also described and illustrated.

Oxy-Acetylene Apparatus.—The L'Air Liquide Society of Montreal, Que., have issued a folder containing a number of leaflets describing their oxy-acetylene apparatus for welding and cutting. The many types of blowpipes for various purposes are described fully and tables give the capacity for each size. Other leaflets describe and illustrate acetylene generators. A number of welding supplies and materials are dealt with in detail, accompanied by price lists. The leaflets are fully illustrated and included in views of the plants at work.

The Phenix Force Feed Lubricator, Bulletin No. 50, recently issued by the Richardson-Phenix Co. of Milwaukee, Wis., contains a complete description of the Phenix ratchet type lubricator; it also describes a new type, known as the model "T." The catalogue contains an interesting diagram, giving a comparison of the way in which mechanical and hydrostatic lubricators feed oil to engine cylinders. Numerous illustrations show the application of the Phenix lubricator to different types of engines, pumps, steam hammers, etc.

Establishing and Maintaining Boiler Room Economy is the title of a paper presented before the Ohio Society of Mechanical, Electrical and Steam Engineers, by Geo. H. Gibson, developing the thesis that the most important requisites to further improvements of boiler plant economy are means of recording boiler performance—that is, of determining the number of pounds of water evaporated per pound of coal. Information obtained sporadically, as by means of short boiler tests, is not so suitable for this purpose as is information supplied continuously, as by a feed water meter. The relative values of different kinds of coal, the improvement in evaporation following cleaning of soot and scale off heating surfaces, or the stopping up of air leaks, the relative merits of different methods of firing, are then readily demonstrated, and scientific management becomes easy and natural. That is, the ways and means of attaining a certain standard of performance having been demonstrated, the management is in a position to ask for good results continuously; in fact, standard rules of operation—that is, directions as to methods of handling fires, regulation of draft, blowing of soot, banking fires, carrying over-loads, etc., can be written out, so that any man following instructions can obtain good results. The installation further arouses the pride of the engineer, and makes it possible to reward skill or attention to duty. This pamphlet is being distributed by the Harrison Safety Boiler Works, Philadelphia, Pa.

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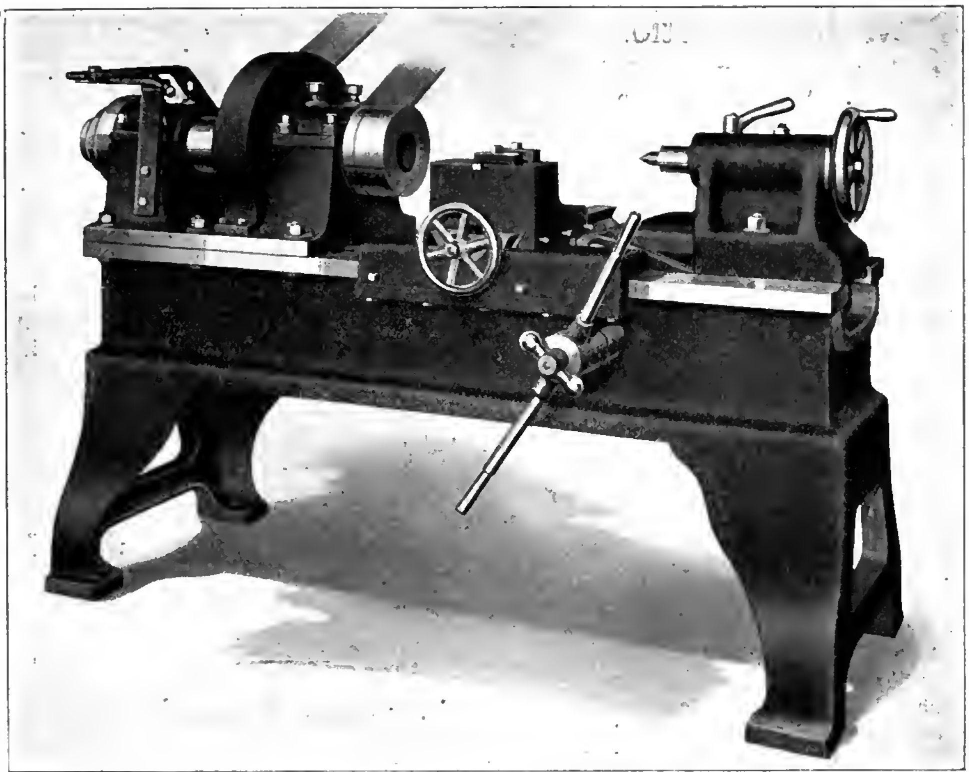

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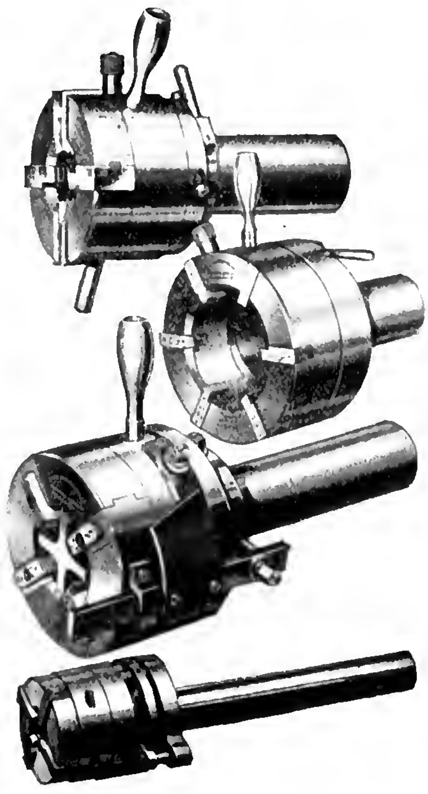

THE GEOMETRIC TOOL CO., New Haven, Conn., U.S.A.

Canadian Agents:

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The A. R. Williams Machinery Co., Ltd., TORONTO, WINNIPEG, ST. JOHN, N. B.

New Incorporations

The Manchester Ironworks, Ltd., of Calgary, Alta., have been incorporated with a capital of $50,000.

The Canadian Northern Ontario Railway Co. is applying for an extension of time for the construction of its authorized lines from Toronto to Windsor, St. Thomas and Sarnia.

The International Exploration Co., of Montreal, has been incorporated at Ottawa, with a capital stock of $2,000,000, and authority to do all kinds of prospecting and development work.

The Three-O-System Co. has been incorporated at Ottawa, with a capital of $250,000, to manufacture stoves, boilers, furnaces, etc., at Toronto. Incorporators: Fred Holmes and E. A. Douglass, of Toronto.

The Canadian Electrode Co. has been incorporated at Ottawa, with a capital of $100,000, to manufacture electrical and other equipment at Montreal. Incorporators: Howard Murray and Wm. S. Hart, of Montreal.

The Ontario Niagara Connecting Bridge Co. has given notice of application to Parliament at Ottawa for an Act of Incorporation, with power to construct and operate a railway and traffic bridge over the Niagara River.

Brantford, Ont.—The city is applying for legislation empowering the corporation to own, operate and extend the Grand Valley Railway under the name of the Brantford Municipal Railway System.

The Canada Cement Co., Montreal, Que., has been granted supplementary letters patent empowering the company to go into the iron and steel manufacturing business, including the manufacture of all kinds of munitions and the development of mines.

Marine

Owen Sound, Ont.—The tugs C. M. Bowman and Maud L. were destroyed by fire on Dec. 13 at Vail's Point harbor, about six miles from here. While cleaning the flues of the Maud L. with a jet of steam, a back draft of soot exploded and blew the fire out of the firebox under the boilers and ignited the woodwork. Captain Geo. Dunn was the owner of both tugs.

Montreal-Longueuil Ferry.—The close of the season of navigation as regards ocean and lake vessels is now succeeded in its turn by the close of the season within the port of Montreal. The Longueuil ferries, Louis Phillippe and Boucherville, have now gone to their winter quarters in the Basin opposite Shed No. 11. The sheds along the Canada Steamship Lines piers have been lifted on to three steam barges berthed at the same place.

Sarnia, Ont.—The steamer Majestic, owned by the Northern Navigation Co., was totally destroyed by fire on Dec. 15 as she lay at the dock at Point Edward, and was responsible for a serious fire on the steamer Saronic, which was moored alongside. The Majestic was operated on the Georgian Bay run from Cleveland and Detroit, and made special excursions each summer. She was built in Collingwood in 1895, and was 209 feet in length, with a beam of 39 feet. The loss is placed at $100,000, and the insurance at $90,000 on the Majestic. The loss on the Saronic is estimated at $25,000.

Contracts Awarded

Fort William, Ont.—The contract for an addition to the plant of the Fort William Coal Dock Co., on Mission River, has been awarded to Roberts & Schaefer Co., Chicago, Ill. Estimated cost, $300,000. C. B. Nineaber, General Manager.

Burnaby, B.C.—The Shell Oil Co., Vancouver, have let the contract for docks, approaches and bulkheads, in connection with the construction of their oil plant on Burrard Inlet, to the Vancouver Pile Driving and Contracting Co., Vancouver.

Railways--Bridges

Milton, Ont.—The hydro-radial bylaw will be submitted to the ratepayers on January 3.

Guelph, Ont.—It is expected that the Toronto Suburban Railway to Guelph will be in operation as far as Georgetown by February 1 and to Guelph by March 1.

Brantford, Ont.—It is reported that a union station will be built here to cost approximately $30,000. It will be used jointly by the Brantford and Hamilton, and the Lake Erie & Northern railways.

Quelph, Ont.—The Council of Puslinch township, through part of which the proposed Hydro-radial line runs, has decided not to submit the by-law at present to raise the $70,300, the share apportioned to that municipality. Eramosa township has not yet decided on the matter, although several meetings have been held to discuss the proposal.

Building Notes

Toronto, Ont.—The Dominion Bridge Co. will supply the steel work for the Imperial Oil Co. new office building.

Hamilton, Ont.—The Canadian Cartridge Co. have secured a building permit for an addition to their factory.

Quebec, Que.—A building permit has been issued to the Public Service Corporation, who propose building a pumping station.

Refrigeration

St. Boniface, Man.—A municipal abattoir will be established here at a total approximate cost of $300,000. It will be located near the Union Stockyards.

Fort Frances, Ont.—It is rumored that Gordon and Ironsides, the meat packers, are contemplating building a branch packing house here. A large storage warehouse with ammonia plant for freezing will be built.

Catalogues

Sand Blast Machines.—The New Haven Sand Blast Co., New Haven, Conn., have issued a bulletin illustrating and describing their automatic sandblast machine. Two types of machine, high and low pressure, are described and some of the principal features of their construction dealt with in detail.

The Sterling Lines is the title of supplement No. 1 to catalogue 11024, issued by the Sterling Wheelbarrow Co., Milwaukee, Wis. The equipment dealt with includes different styles of steel foundry flasks for a large variety of work. Each style is illustrated and its principal features described at length. The catalogue is illustrated in an attractive style.

Air Brushes.—The Paasche Air Brush Co. have issued a booklet No. 10 describing a complete line of air brushes and attachments. The different models of air brushes are dealt with in detail and method of operation described. The various parts and attachments are illustrated and described in detail, while prices and other information is included with each.

Rotary Planing Machines, made by the Newton Machine Tool Works, Inc., are illustrated and described in catalogue No. 50. Each of the various types is illustrated and briefly described and a general specification is included. A section of the catalogue, printed on colored paper, deals with slotting ma-

chines, cold metal saws, milling, boring and planing machines, etc. In this section a number of types are illustrated and the principal dimension given for the various sizes. Other illustrations show rotary planing machines in operation. The catalogue contains 36 pages, and is gotten up in an attractive style.

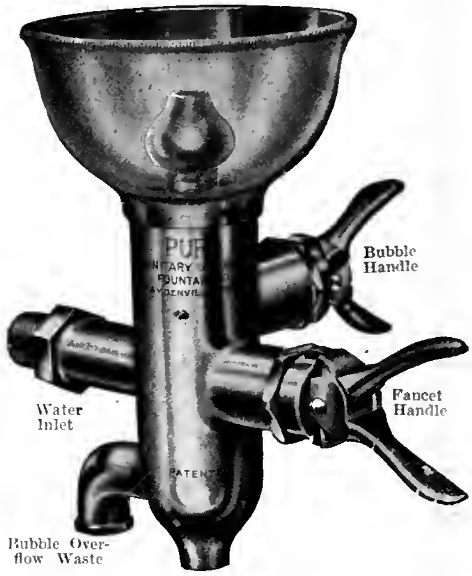
Metal Cutting Saws.—The Simonds Mfg. Co., Fitchburg, Mass., have issued a very attractive catalogue dealing with their various products, which include metal saws, hack saws, files, machine knives, saw blades, etc. The various lines are illustrated and are accompanied by tables giving particulars and prices of the different sizes. A complete price list of files and saws is included, as well as for hack saw blades. Several pages are devoted to different methods of cutting steel and contain much valuable material on the subject for the buyer, dealer and operator. A copy of this catalogue will be sent free to any machinist writing for it.

Book Reviews

The "Mechanical World" Pocket Diary and Year Book for 1916. Published by Emmott & Co., Ltd., Manchester, England. Price, 25c. The twenty-ninth issue of this extremely useful little publication is now on sale, and, as is the usual custom, additional information has been introduced. The section on steam boilers has been largely rewritten and enlarged, including particulars of boiler scantlings, the requirements as to boiler mountings, etc. A separate and enlarged section is now devoted to the Diesel engine, embodying a good deal of concisely arranged data which will be appreciated by designers. Some notes on brazing and soldering have also been introduced. Among the several new tables, mention may be made of those relating to Lancashire and Cornish boilers, dimensions of locomotive boilers, steel plates, friction clutches, circle spacing table, etc. Other tables have been extended, and the book generally has been thoroughly revised. The book contains 264 pages full of useful engineering notes, rules, tables and data, etc.; while in addition there is the usual diary, index and advertising matter, a total of 429 pages. The book is fully illustrated and bound in substantial cloth covers.

SITUATIONS VACANT

POSITION OPEN — TWO FIRST-CLASS machine shop foremen, with thorough experience in tooling up and operating a plant for the larger sized high explosive shells. Only men with excellent references covering this class of work need apply. To receive attention, full particulars must be given in the first instance, of experience, by whom previously employed, age and salary expected. Box 161, Canadian Machinery. (1)



TRADE, COMMERCE, AND TRANSPORT

Embracing Statements of Manufacturing Output, Records of Imports and Exports, Company Statistics, Provincial Revenues and Trade Possibilities, Etc.

CANADIAN SHIPBUILDING DURING 1915.

DESPITE the fact that the manufacture of munitions has in large measure displaced that of other steel and iron products, shipbuilding and ship-repairing in Canada may be said to have maintained at least its average activity in both departments. The conclusion of the war, and, of necessity, probably earlier, will witness an enlargement of both shipbuilding and marine engineering production everywhere, and we in Canada cannot fail to participate to some extent, even be it but to fill our own needs, which are daily becoming more pressing. The following details covering the work of the year 1915 have come to hand:

Collingwood Shipbuilding Co.

This establishment is enjoying considerable activity in new work, having launched on the 15th of December, the first of two vessels under construction for the Imperial Oil Co. These boats are being specially built for carrying oil on the Great Lakes, but the equipment includes all the necessary appliances for ocean service. Principal dimensions: Length, 258 feet; beam, 43 feet; depth, 18 feet. The large freighter for which a contract was recently closed, is now in course of construction and will employ a considerable number of hands during the winter. Particulars of this boat are as follows: Length, 550 feet; beam, 58 ft.; depth, molded, 31 ft.; gross tonnage, about 8,000; deadweight on 19 ft. 6 in. mean draft, 11,000 tons. Three Scotch type boilers each 13 ft. diameter by 11 feet long, will be installed, the triple expansion engines having cylinders 24 in., 40 in., 66 in., dia. by 42 in. stroke. Other launches included a steel steam hopper barge for the Department of Public Works, Ottawa, for use on the St. Lawrence River. This barge is self-propelled, with the following dimensions: Length, 187 ft.; beam, 32 ft.; depth, 14½ ft. The usual quota of general repair work has been completed with encouraging prospects for a good share of this class of work during the ensuing months. The production of 18-pdr. shrapnel and 4.5 high explosive shells has been, as elsewhere, an important development at this plant.

Polson Ironworks, Toronto

The accompanying tables indicate at a glance the substance of the shipbuilding and marine engineering work completed and in process at the yards of the Polson Ironworks, Toronto. In addition to what is there stated, a considerable amount of new and repair, general and stationary engineering and boiler construction has been put through during 1915. Shell production has formed a quite important feature of the total output to the year's credit, and we are informed that in every direction of the firm's activities, the prospects for the ensuing year are in every respect encouraging.

Repair Work, 1915— Polson Ironworks, Toronto

Name of Vessel.	Owners.	Description of Repairs.
Ontario No. 1	Ontario Car Ferry Co. Can. Government	New H.P. cylinder port engine. New firehold floor. Patent stern gate similar to No. 2. Portable hatches over engines. Boilers electric welded, and general overhauling.
Dredge No. 117	Dept. Public Works	General overhauling.

Vessels Completed 1915—Polson Ironworks, Toronto.

Name of Vessel	Yard No.	Type	Principal Dimensions	Gross Tonnage	Engines	Boilers	Speed	Designation	Date of Launching	Port of Registry	Owners.
C. G. S. Grenville	119	Buoy Steamer	Length 164'-6" Breadth M. 30'-0" Depth M. 13'-0"	497	Triple exp'n 14"-22½"-38" 24"	2-Scotch 10' dia. 11'-0"g. Howdens Draught	13 miles	Lloyds 100 A1	Nov., 1914	Ottawa	Can. Govt., Dept. Marine and Fisheries
Ontario No. 2	126	Car Ferry	Length 318'-0" Breadth M. 54'-0" Depth M. 20'-6"	5567	2-Triple exp'n 20½"-33"-54" 36"	4-Scotch 14' dia. 12'-0"g. Howdens Draught	15 miles	Great Lakes	April, 1915	Montreal	Ontario Car Ferry Co.
Wanda III.	127	Yacht	Length 94'-0" Breadth M. 12'-0" Depth M. 6'-0"		Triple exp'n 9"-13½"-20" 11"	1-Thornycroft 1220 sq. ft. H. S.	18 miles		May, 1915	Toronto	Mrs. T. Eaton
Patricia	128	Motor Tug	Length 36'-0" Breadth M. 9'-6" Depth M. 4'-0"		30 H.P. Heavy Duty Gasoline		10 miles		June, 1915		Hudson Bay Co.

Kingston Shipbuilding Co.

During 1915 no new vessels were built at the plant of the Kingston Shipbuilding Co., Kingston, Ont. The amount of repair work was well up to the average, and in the matter of the immediate future in this respect, the following vessels are in hand:—Keyport, repairing stem damage; Keywest, Keybell, Keyvive, Saskatoon and Arabian, repairing bottom damage.

Western Drydock and Shipbuilding Co.

No new tonnage construction work appears on the 1915 record of the Western Drydock & Shipbuilding Co., Port Arthur, Ont.; it will be noted, however, that the ship repairs undertaken were quite heavy. An addition to the regular line of work was the manufacture of light tractors for farm work, twelve carloads of which were shipped to the Western provinces. Owing to the abnormally high price of steel and unsatisfactory deliveries, any increase in activity during the early part of the year is not looked for unless an unexpected change in conditions takes place. Repair jobs in dry dock during season of 1915 included the following steamships: Paliki, 17 shell plates and general overhauling for classification with Lloyds; Turret Chief, partially reconstructed, including the replacing of 119 plates; Frater Taylor, 14 plates and 19 feet of stem; Turret Cape, 21 plates; Glenlivet, 26 plates; Pellatt, 1 plate; Glenlyon, repairs to top and hatch coamings; Collingwood, 11 plates; A. E. Ames, 22 plates; Meaford, 38 plates; Glenfinnan, 25 plates; Lehigh, 1 plate; Inland, 26 plates.

Canadian Vickers, Ltd.

There are at present under construction at the plant of Canadian Vickers, Ltd., Montreal, the following vessels for the Canadian Government:—Steel twin screw icebreaker, of length over all, 292 ft., 57 ft. 6 in. moulded breadth, and 32 ft. moulded depth; steel twin screw centre ladder and hopper barge loading dredger, of length over all, 292 ft. 1½ in., 48 ft. moulded breadth, and 20 ft. 6 in. molded depth. During the 1915 season of navigation, twenty-four vessels were docked and repaired on the floating ship dock Duke of Connaught. In addition, repairs were carried out on a large number of vessels afloat. The foregoing is altogether exclusive of naval armaments or war munitions work.

M. Beatty & Sons, Welland, Ont.

In addition to a considerable number of repair jobs carried out on vessels plying between Port Colborne and Montreal, M. Beatty & Sons completed during the past year the 20-inch, all-steel, hydraulic dredge Primrose to the order of the Canadian Dredging Co., Midland, Ont., for service on Section 5 of the new Welland Ship Canal. They also built and completed a steel fishing tug for Misener & Tedford, Port Burwell, Ont. Alterations are at present proceeding on the steamer Algonquin, preparatory to that vessel entering ocean service next spring. The steamer Nyanza is also being overhauled, and prospects are quite equal to the average of former years in the matter of refitting lake craft wintering at Port Colborne and elsewhere.

MANITOBA'S SHARE OF RAILWAY PROGRESS

EVERY mile of steel that has been, is being or is to be laid in the four Western provinces is of value to the province of Manitoba, and to some extent to the city of Winnipeg, which is the only through connecting point between the east and west in Canada. The three transcontinentals pass through Winnipeg and through Manitoba, and the value of this city and this province as a shipping centre is added to by every mile of new railway built further west.

The growth of the mileage of Canadian railways reads like a miracle, and is shown in the following comparative statement:

1867	2,278
1877	5,782
1887	12,184
1897	16,550
1907	22,452
1914	20,795

The Canadian Bankers' Journal sums up the story of railway building thus: "From Confederation to 1887, a period of twenty years, we added 9,806 miles of railway to the aggregate mileage of the Dominion; whereas in the succeeding 27 years we added 18,611 miles. Putting it in another way, so as to bring the angle of comparison into sharp relief, we constructed an average of 490 miles per annum during the two decades following Confederation, and during the past seven years have built at the rate of 1,192 miles per annum. We have gained momentum as we proceeded, and when the war came along last August we were going a great deal faster than ever; for at that time we actually had 5,521 miles of line under contract, 3,417 miles ready for train service, and 2,443 miles in operation, a total of 11,381 over and above the 30,795 given as the official mileage for 1914."

The Dominion government, provincial governments and municipalities have given liberally to railways, and the province of Manitoba has not been behind in its guarantees and subsidies. Up to the 30th of June, 1914, the Dominion and provincial Governments had authorized guarantees on railway bonds to the amount of $406,259,165, the account in detail standing as follows, according to the Journal of the Canadian Bankers' Association:

Dominion	$188,965,062
Manitoba	25,221,580
Alberta	55,810,450
Saskatchewan	41,625,000
Ontario	7,860,000
British Columbia	7,860,000
New Brunswick	6,063,000
Quebec	392,000
	$406,259,165

These figures show that Manitoba has been a little more conservative in guaranteeing railway bonds than the other Western provinces, having become liable for less amounts than either Alberta, Saskatchewan or British Columbia, the Manitoba total guarantee being less than half of Alberta's, and less than a third of British Columbia's.

Of the new mileage constructed and under construction, eighty per cent. is located in the Western provinces, and the editor of the above quoted journal remarks that "No one would dare to put a limit on the probable development of those provinces after the disturbance created by the present war has subsided."

The gross earnings of the Canadian railways in 1914 reached the large total of $243,083,539, and the 1915 will be even larger. The following comparative statement is interesting, showing the earnings of the railways since Western development was first started:

1877	$ 19,470,539
1887	38,841,609
1897	52,353,276
1907	146,738,214
1914	243,083,529

Eight Canadian railways last year paid a dividend on common stock, the dividend payments totalling $24,522,264.

CANADA'S TRADE WITH BRITAIN

OFFICIAL figures of trade between Canada and Great Britain, forwarded from London by the Canadian Associated Press, throw an interesting light on the preliminary return for the month of November issued from Ottawa a week ago.

Large increases in British imports of Canadian grain, flour and food articles of various description constitute the main feature of the return. In a list of ten articles ranging from wheat to lobsters, the figures show an advance from £2,156,000 a year ago to £3,239,000, a gain of about 50 per cent., although imports of like articles in November last year were on a fairly large scale.

Except in wool, pig iron and steel bars, British exports to Canada for the month were generally lower. Some of the leading figures compare as follows:

Imports from Canada

	1915.	1914.
Wheat	£1,860,837	£1,401,146
Wheatmeal & flour	300,505	96,174
Barley	100,922	14,771
Oats	12,475	40,699
Bacon	314,631	91,446
Hams	26,186	8,726
Butter	44,730	336
Cheese	447,459	466,860
Canned salmon	66,242	36,971
Canned lobsters	66,064	224

Exports to Canada

Spirits	36,393	54,767
Wool	29,080	9,877
Pig iron	15,362	873
Wire	998	1,811
Galvanized sheets	2,473	26,486
Tinned plates	3,758	16,967
Steel bars	16,456	4,788
Pig lead	1,015	1,232
Cutlery	5,015	6,226
Hardware	1,652	2,910

Montreal, Que.—From January 1 to December 22, 1915, the building permits totalled 2,053 of a value of $5,635,921. These figures are for the city of Montreal only, as although Maisonneuve, Verdun, Outremont and Westmount are within the limits of Montreal, they are each separate municipal corporations.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents

Montreal, Que, Dec. 27, 1915.—The passing of Christmas week, with its accompanying slight relaxation from business, has not been signalized by any marked occurrence in the industrial situation. Recent developments in Britain point to the probability that the organization of industries in that country is now very well in hand, reducing the likelihood of continued dependence for supplies on sources outside the Empire. Activities with this end in view have been in progress for some time, official evidence of the fact being afforded by the recent restriction of machinery imports.

The reaction of this will be felt in a general easing of the present tension in both raw and finished products, although the present domestic activity in the States will tend to maintain the Canadian situation unaltered for some time.

Pig Iron

The market is quiet with no change. Until present contracts are nearing completion, no decided tendency in either direction is expected to arise.

Steel

Congestion remains unrelieved. All available producing capacity is more than fully booked, and additional production has not yet been available to mitigate the situation. The absence of official indications regarding the continuance of shell contracts is causing some slight comment and may possibly retard the further rise in material in general for this class of work. Increased activity in general lines is looked for the beginning of the year, but no price changes are noted on the market.

Machine Tools and Supplies

The possibility of relief in the machine tool industry was somewhat strengthened by the restriction of imports to Britain on the part of the authorities there. The conditions of the license under which importations are allowed restricts the business to firms of established reputation, several of whom have already acted as channels for the distribution of Canadian products. The continuance of desirable export business from this country will continue if not increase along certain lines, but if the development is due, as some parties maintain, to the sufficiency of home equipment, purchasers in this market may reasonably expect some relief.

Supplies generally are unchanged, a slight upward tendency being shown in some brands of sheets. The tool steel situation remains unchanged with drills and small tools generally in brisk demand.

Metals

The market is still strong, an upward tendency being noted in several lines, especially in copper. Lead also continues strong.

Copper.—Last week's advance of $10 per ton has been more than continued, an increase of $20 per ton bringing it up to $23 per hundred. Electrolytic copper shows an even greater advance, rising from $21.75 to $23, while the prevailing tendency is further shown by the advance in castings to $22, an increase of 75c per hundred.

Tin.—Business continues quiet, no further developments having been reported regarding possible delays to shipments from abroad. Prices continue at 45c per pound.

Spelter.—No apparent activity has been displayed during the week. The market continues firm at 21c per pound.

Lead.—Last week's upward movement has been more than maintained, an increase of 15c bringing it up to $7 per hundred. As no increase in consumption has been noted, this change would indicate a continued firmness in demand.

Antimony.—This continues steady with no developments of note. Supply is well up to demand with price unchanged at 42c per pound.

Aluminum.—The decline of 2c reported last week marks the extent of the drop. Any considerable decrease cannot be expected as long as the demand for military requirements continues. The price remains at 68c per hundred.

Old Materials

The market for scrap continues good, all lines being steady with marked increases in a few. Increased demand has caused a stiffening in iron, No. 1 wrought advancing to $11.50 per hundred, an increase of $1, a similar movement being repeated by No. 1 machinery cast iron. No. 1 machine composition continues strong at $12.50. Copper shows marked firmness in sympathy with raw material, an advance of 75c per hundred bringing it up to $17. Aluminum and lead are unchanged.

Toronto, Ont., Dec. 30.—The industrial outlook at the close of the year is distinctly encouraging, and conditions are unquestionably better than were anticipated early in the year. Twelve months ago the country had recovered from the slump which immediately followed the outbreak of the war, but at the same time trade was quiet and there was little definite assurance of any marked improvement in industrial prospects. Within a short time, however, large war orders began to be placed in Canada and the whole outlook changed completely, numerous factories starting overtime on equipment necessary for Britain's armies; consequently conditions improved in many industrial centres. This industrial activity, although due in large measure to war orders, especially in the early stages, has had the effect of stimulating domestic trade. The record crop has also added its quota to the general prosperity prevailing and has been of material assistance in restoring in business circles that confidence in the future so necessary for industrial development.

While trade has been gradually improving prices have been advancing and cost of raw material rising all the time. This year has demonstrated more so perhaps than any similar period, the important part which the steel trade plays in the development of a country. As soon as the steel trade became unusually active and prices of iron and steel began to rise, there followed a general advance in finished steel and iron goods affecting the entire community. This condition has been prevailing for some time and the top of the market has not been reached yet. There is not the slightest doubt but that prices will continue to advance during the first few months, at any rate, of 1916, at which time other influences may bear on the situation and continue to stiffen the market. How long present conditions will last depends upon the duration of the war, and this latter is impossible to foretell. The obvious policy under the circumstances, however, is for manufacturers to organize their particular business so as to take advantage of any export demand that may develop as a result of the war.

Prices on all steel products continue to gradually advance and higher levels are expected in the near future. In the machine tool market business is fairly active, but the holiday season has restricted trade to some extent; however, some enquiries have been received for lathes for the larger shells. The metal market is quiet this week, being also under the influence of the holiday season. There are no price changes to note, although these are for the most part firm.

Steel Market

The iron and steel market at the end of the year 1915 is in an exceptionally strong position. The demand is great and prices have attained a level never before known in the history of the trade in Canada. The steel companies, even with the large extensions to their plants, are operating at capacity and when the

boom subsidies will be in a position to handle an extremely large volume of business in normal times. The profits made during the year have placed the companies in a sound financial position which will place the steel trade on a firmer basis than formerly. The market is very firm and prices on all steel products are gradually going higher. Boilers and structural rivets, ¾-in. and larger, have advanced and are quoted at $4. Brass wood screws have advanced again. Higher prices for boiler plates and tubes may be announced shortly, while other lines are also expected to advance.

There is no change in the galvanized sheet situation which is very unsettled. Black sheets continue to advance, while spelter and acid are still high in price with little prospect of being cheaper for some time. There is still a considerable range in prices of galvanized sheets, and some makes are practically out of the market. Mills producing black sheets are running full time and have a large amount of work ahead. Black sheets, No. 20 gauge, are being quoted at a 2.50c to 2.60c basis, and blue annealed, No. 9 and 10 gauge, 2.25c basis, Pittsburgh. An extraordinary situation, closely connected with the steel trade, has arisen in the States. Railroads running into New York have placed an embargo on all shipments of iron and steel products destined for export. The freight yards have been gradually becoming more congested with export shipments for some time, due to shortage of ocean tonnage and heavy export shipments. This serious situation can hardly be relieved unless more tonnage is requisitioned to take care of the ocean transportation. The embargo, while being of material relief to domestic consumers, does not appear to be making the market any easier. Prices continue to advance and some authorities believe the market to be in a top-heavy condition. Prices on contract bars, plates and shapes, now generally 1.80c Pittsburgh, are at the highest level since the formation of the U. S. Steel Corporation. Bessemer and open-hearth billets have advanced again and are now quoted at $32 and $33 per gross ton, Pittsburgh, respectively. Forging billets are unchanged at $52, Pittsburgh.

Pig Iron

The market is quiet but strong with a tendency to higher prices. The furnaces are operating at capacity as the demand for steel-making pig continues heavy. Prices of grey forge, Pittsburgh, have advanced to $18.10 per gross ton, while Hamilton and Victoria iron are unchanged at $24 per ton.

Old Materials

The market is firm and prices generally unchanged. A good demand for scrap copper continues and prices are very firm. Heavy melting steel is also active and prices firm. Supplies of old aluminum are being quickly taken up and prices will go higher.

Machine Tools

A very prosperous year for dealers and builders of machine tools is closing. Local dealers have been remarkably busy for practically the entire year The heavy demand for both new and second-hand tools has been unprecedented. At the present time machinery houses are not so busy as during the summer but they still have plenty of enquiries and orders on hand. An interesting feature during the year has been the development of special tools for making shells and shell parts, which has been the means of keeping many machine shops actively employed. Prices of machine tools have increased considerably during the year, due to increase in cost of raw materials and higher cost of production. The increase in the tariff early in the year also affected imported machinery.

CANADIAN GOVERNMENT PURCHASING COMMISSION

The following gentlemen constitute the Commission appointed to make all purchases under the Dominion $100,000,000 war appropriation:—George F. Galt, Winnipeg; Hormidas Laporte, Montreal; A. E. Kemp, Toronto. Thomas Hilliard is secretary, and the commission headquarters are at Ottawa.

Supplies

Prices of some lines have advanced and other price changes are expected during the early part of 1916. The heavy demand for lard oil has caused an advance, being now quoted at $1.10 per gallon. Gasoline and benzine have advanced 2c and are now quoted at 27½c and 27c per gallon respectively. Coal oil is also 2c higher. The serious shortage of crude oil and the big demand for gasoline have created a serious situation, and prices of gasoline are almost certain to go higher. Linseed oil and turpentine are unchanged, although higher prices are expeced for the former in the near future. Another advance in cotton waste is expected in the New Year. Prices of small tools are expected to advance early in 1916.

Metals

There is little of interest to note in the metal market this week, it being under holiday influence. There are no important price changes to note, the market being generally steady. The tin market is unsettled on account of possible interference with shipments of tin in the war zone. The situation in the copper market is strong and higher prices are looked for. The spelter market is quiet and firm. It is reported that a bounty on spelter is being advocated in England to encourage the industry. The lead market is firm and unchanged while antimony is very quiet. Aluminum is weaker but unchanged. There is no change in prices of solder.

Tin.—There is considerable uncertainty in the tin market owing to the possibility of shipments being lost at sea or some new British regulation affecting the transportation of tin. The market has been quiet over the holiday period and trading has been almost suspended. Quotations are unchanged at 43c per pound.

Copper.—The copper situation is a very strong one and higher prices are looked for in the near future. The British Government has contracted for many thousand tons of copper in the States for delivery during 1916, but the price has not been definitely disclosed. There is a scarcity of spot copper, and consumption is reported to be greater than production; the demand continues heavy. Local quotations are unchanged at 21¼c per pound.

Spelter.—The market is quiet but very firm. Inquiry has been light but some business has been done, consumers being inclined to wait developments. The exports from the States continue heavy, and an increased demand is expected. Quotations are unchanged at 19c per pound.

Lead.—The situation is unchanged and the market is very firm with an upward tendency. Trading has been light on account of the holiday season. The "Trust" price of 5.40c, New York, is being maintained. Lead is quoted locally at 7c per pound.

Antimony.—The market is quiet but very firm for prompt and January deliveries, and there is good enquiry for futures. Consumption of antimony continues heavy and is getting ahead of production. Local quotations are firm and unchanged at 40c per pound.

Aluminum.—The situation is unchanged with the market a trifle easier. Aluminum is quoted at 65c per pound.

Winnipeg, Man., Dec. 18.—While most of the shops in Winnipeg are busy, they are nearly all busy on shell manufacture, and mostly on 18-pdrs. There is some doubt, now that work is to be let out by tender, whether contracts will be coming to Winnipeg in future, as wages and cost of material are higher than in the East. In view of this uncertainty, it is rumored that some firms have cancelled their orders for special machinery which they were contemplating installing.

Considerable satisfaction is felt here

over the announcement that shells are to be made at the N.T.R. Transcona Shops. Equipment had already been purchased and installed, and shells were being made in these shops many months ago, although recently work was suspended. The contract has now been resumed, being under the auspices of a concern formed for the particular purpose. As the Transcona shops had passed from the control of the G.T.P., making it difficult for them to carry out their shell contract, an arrangement was made with the approval of the Imperial Government to transfer the order to the Transcona Shell Co.

As already stated, the necessary machinery was already in the shops, and all that was required was some transmission equipment, orders for which were placed with Winnipeg houses. This consisted mostly of shafting and hangers. While the demand for machine tools is good in Western Canada, the supply is not equal to the demand. A firm who placed an order for a number of lathes with a local supply house were told that delivery could not be made until next fall, which is a long while to wait for a firm anxious to get down to business. One of the largest machinery houses here has shipped every iron-working machine they had in stock to the East, and are now without stock of any kind. Furthermore, they are afraid to secure stock on the present high market, especially when it is doubtful whether further orders for shells will be coming this way, although it is rumored that a firm in Regina has secured a contract to manufacture 20,000 60-pdrs.

Structural Firms Disappointed

Considerable disappointment is expressed by structural firms here that, with such a large crop, more business was not available for grain elevators. The lumber business, which has been in deplorable shape for three or four years, is recovering sharply, and owners of saw mills are making repairs and installing new machinery in anticipation of a revival of business. This is a result of the good crop. Farmers have money, and will be using considerable lumber on their farms during the coming year. There is a brisk demand for woodworking machinery.

The demand for transmission equipment has been fair, same being required for general repairs to machine shops, laundries, saw mills, etc. There has also been a demand for transmission supplies from flour mills, a number of which have been rebuilt. Laundry machinery has been one of the best selling lines during the past two months, strange to say. There has been a fair demand for electric motors locally. The boiler trade is quiet, the few selling being for heating purposes, or for country plants. A distinct improvement has been observed in the demand for bar iron.

Lack of Shell Orders

While most of the Winnipeg machine shops and other engineering establishments are busy on the manufacture of shells, and while the railway shops at Transcona are beginning work on a large contract, and other companies are being organized here for shell manfacture, there is a feeling that Winnipeg has not been treated square in this matter. The head of one of the largest shops expresses himself in the following words: "We have a large capacity in Winnipeg for making shells, and could turn out from 50,000 to 60,000 per month, which could be increased to 100,000 by the purchase of additional equipment. Our chief trouble here has been shortage of material, and we have been delayed continually by difficulty in getting component parts, particularly copper bands. These are being shipped from the East, as we have not the facilities for making them here.

"We have been making 18-pdr. high explosives right along, and have been unable to secure orders for anything else. There are no plants idle here at present, but there probably will be when contracts are awarded by tender. We would instal new equipment if we got the orders, and we have got as good credit as any firm in the East. We could finance any amount of equipment required."

The 1915 Crop

The big crop of 1915 has been the salvation of Western Canada, and it is freely predicted that if there is an equally good crop in 1916, building will start again in great style. As it is, there is little building going on in the towns and cities—that is, compared with the amount of construction work of two years ago. The farmers are building, but it will be mostly lumber they require, and the cheaper kind of hardware. This has, however, given a stimulus to the sale of heavy hardware, such as iron and steel bars, sheets, etc., and a revival in the lumber business is expected, which is already having its effect on the demand for saw mill machinery and transmission supplies.

All the trades have benefited by the crop, particularly hardware, grocery and dry good trades. When the farmers secured money for their crops, they began to buy things which they had been unable to afford for years, with the result that storekeepers at country points found themselves unable to cope with the demand, having allowed their stocks to run exceedingly low. Consequently orders were wired to Eastern jobbers, asking immediate delivery, which in many cases was impossible, the jobbers themselves having failed to anticipate such a heavy demand. The jobbers in turn fell back on the producers, who were also unable to make immediate deliveries. The result in the case of groceries was that supplies commenced to arrive around Christmas, almost too late to be of any use to the dealer. In the meantime, the farmer turned to his mail order catalogue, but even there found difficulty in securing what he wanted at once.

Hardwaremen Busy

Winnipeg hardware jobbers have not experienced such a period of good business for many years. They are putting through carload orders, which is very unusual at this time of the year. They are busy from the basement to the ceiling, in every department. Particularly pleasing is the fact that the West is buying sporting goods, which is a luxury the farmer has been unable to afford for several years. The man who had an old gun made it last out over the period of depression. He is now buying a new one. Sporting goods is a line that the hardware merchant can soon sink a lot of money in, and he would not be buying so freely if he were not sure of disposing of it.

As an indication of what the big crop means to the West, it is only necessary to cite the case of Herbert, Sask. Last year this town raised thirty ears of grain, which was all taken by the local mill. This year Herbert has raised 3,000 cars, and by the middle of December had only been able to ship 1,500 cars. The crop in Manitoba averaged twenty-seven bushels to the acre, whereas in normal years it only averages about seventeen bushels. Cases are cited of farmers growing sufficient grain to pay for their farms.

Shipping Casualties in November.—The number and net tonnage of British vessels, respecting the loss of which reports were received at the Board of Trade during November, and the number, and the number of lives lost, were: —Sailing vessels, thirty-five, net tonnage 4,977, lives lost six; steamships fifty-three, net tonnage 61,072, lives lost 646. Among this number were twenty steamers of 48,523 tons, sunk by German warships, ten steamers of 4,654 tons, sunk by mines, and one steamer of 864 tons, sunk by a German warship or mine. Four hundred and ninety-five lives were lost in steamers sunk by German warships, of which 315 were lost in the Ramazan, and 167 in the Marquette, 58 in steamers sunk by mines, and 20 in steamer sunk by a German warship or mine.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News

Engineering

Toronto, Ont.—The Universal Tool Steel Co. will build an addition to their plant to cost $7,000.

Lunenburg, N.S.—The foundry owned by Leonard G. Holder has been completely destroyed by fire.

Marysville, N.B.—The Canadian Cottons, Ltd., will install an auxiliary power plant and transmission lines.

Owen Sound, Ont.—Keenan Brothers, Ltd., are in the market for an engine lathe and plain milling machine.

Ottawa, Ont.—E .Williams, 172 Glenora Avenue, is receiving prices on steam boilers, hot water boilers, electric pumps, steel tanks, etc.

Orillia, Ont.—Work has been started on the erection of an addition to the factory of the National Hardware Co., at an estimated cost of $20.000.

Arnprior, Ont.—McLachlin Bros. propose to add to their plant a mechanical pulp mill with a capacity of 100 tons daily. Estimated cost, $500,000.

Port Arthur, Ont.—The Western Machinery Co. will shortly move into larger premises on North Court Street, and will install a quantity of new machinery.

Hamilton, Ont.—The Monarch Machine Tool Co. are about to occupy the factory at Young and Ferguson streets, and will make alterations to the building.

London, Ont.—The London Gas Engine Co. plant was recently purchased by W. H. Heard of the Spramotor Co. Additions costing $40,000 will be made to the plant.

Montreal, Que.—The Canadian Electro-Products Co., incorporated with a capital stock of $500,000, with J. S. Norris, Howard Murray and Julien C. Smith as directors, has purchased the Record Foundry Building here, and is installing machinery for the manufacture of shells and other munitions. It will also install an electric furnace.

Municipal

Midland, Ont.—The by-law to raise $13,000 for waterworks extensions has passed.

Port Credit, Ont.—A hydro-radial bylaw will be submitted to the ratepayers on Jan. 1.

Melford, Sask.—The town council propose to purchase one 240 h.p. oil engine for the civic power plant.

Bagotville, Que.—The construction of an electric lighting system at an approximate cost of $7,000 is contemplated.

Cornwall, Ont.—It is proposed to spend $25,000 on waterworks extensions and improvements at the pump house.

Watford, Ont.—The town council contemplate installing a hydro-electric system. A bylaw will be voted on in January.

Edmonton, Ont.—The by-law to authorize an expenditure of $274,966 on a sewage disposal plant has been passed by the ratepayers.

Aylmer, Ont.—The installation of an electric pumping plant and extensions to the lighting system are being considered by the Board of Works.

Tara, Ont.—It is intended to spend $7,500 on a hydro-electric distribution system. A by-law will be voted on by the ratepayers on Jan. 3.

Wellesley, Ont.—An expenditure of $7,500 is contemplated on a hydro-electric system. A by-law will be submitted to the ratepayers on Jan. 3.

Gravenhurst, Ont. — Extensions are proposed to the street lighting system to cost $3,500.. A by-law will be submitted to the ratepayers in January.

Windsor, Ont.—A by-law has been passed authorizing the construction of extensions to the hydro electric system at an approximate cost of $50,000.

Springfield, Ont. — A by-law was submitted by the town council on December 29 to provide for the installation of an electric plant at an approximate cost of $5,000.

Komoka, Ont.—The Lobo township council will submit a by-law to the ratepayers on January 3 to authorize the borrowing of $4,000 for the construction of a hydro electric system.

Cobourg, Ont.—A by-law will be voted on by the ratepayers on Jan. 3 to authorize a loan of $5,000 to George Thompson to assist in the building of an extension to the Cobourg Steel Co. plant.

Newcastle, N.B.—The Town Council will install a motor-driven centrifugal pump of 350 gal. per minute capacity at its waterworks at a cost of $2,000. D. A. Jackson is electrical engineer.

Sherbrooke, Que. — The city council will shortly call for tenders on general repairs and improvements to the power plant. Plans are also being prepared by consulting engineer, M. A. Sammett, Montreal.

General Industrial

Chatham, Ont.—There is a possibility of a shoe manufacturing concern taking over the plant of the Wolverine Brass Co.

Saskatoon, Sask.—The Golden West Milling Co. will start work immediately on the erection of a flour mill at Wakaw, Sask.

Cap Madeleine, Que.—The Union Bag & Paper Co. of New York are considering the erection of a print and sulphide mill here.

Prescott, Ont.—Extensive repairs are being made on the building which the Newell Mfg. Co. have purchased for their local factory.

Woodstock, Ont.—Fire of unknown origin destroyed the flour mill of Maycock & Harris of Princeton on Dec. 27, entailing a loss of $10,000.

St. Mary's Ont.—Messrs. Weir & Weir have taken over the Victoria Mill, which will be overhauled and equipped with flax mill machinery.

Toronto, Ont.—Fire on December 24 destroyed the Martin Corrugated Paper Co.'s factory, the loss being estimated at $225,000, including machinery valued at $125,000.

Toronto, Ont.—The Goodyear Tire & Rubber Co., of Akron, Ohio, are going to establish a branch in Canada, and have completed arrangements whereby a plant will be located in New Toronto, near here. A by-law will be voted on by the ratepayers on Jan. 8 to grant a fixed assessment.

Trade Gossip

The North American Chemical Co have increased the capital stock of the concern to $100,000.

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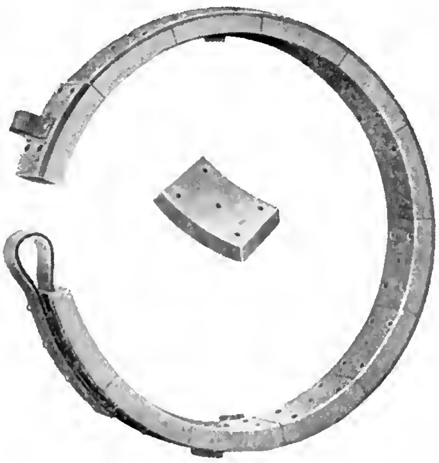

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TORONTO MONTREAL WINNIPEG VANCOUVER

The Munro Steel & Wire Works, Ltd., Winnipeg, are amalgamating with the Hero Manufacturing Co.

The Ford Motor Co. of Canada, Ltd., Ford, Ont., will increase the capital stock of the concern to $10,000,000.

Niagara Falls, Ont.—The Spanish Niagara Tramway Co. have nearly completed the aerial tramway over the whirlpool.

The Canadian Ice Machine Co., Toronto, Ont., have been awarded a contract for a refrigerating plant by the Windsor Ice & Coal Co., Windsor, Ont.

Much Hydro Power in U.S. Available.—Government experts estimate that of the 26,000,000 horse-power which it is possible to develop hydro-electrically in the United States 19,000,000 horse power lies west of the Rockies.

Tungsten Ore Exports.—By an order dated October 30, 1915, the exportation from British India of tungsten and wolframite or any other ore of tungsten is prohibited except under a permit signed by the chief Customs officer.

Three Rivers, Que.—The Three Rivers Traction Co., which inaugurated their city line here on the 11th instant, opened on December 21 the extension line to Baptist Island, where the mills of the Wayagamack Pulp & Paper Co. are situated.

Brantford, Ont.—The Hydro-Electric Commission report for the past year shows that a net surplus in the neighborhood of $16,000 to $17,000 over and above the operating expenses and capital account means lowered rates amounting to one dollar per light for the street lighting circuit. The taking of 1,000 horse-power by the Lake Erie will mean a further decrease in local rates.

M. Beatty & Sons, Ltd., Welland, Ont., have received an order from the Confederation Construction Co., contractors on section 3, Welland Ship Canal, for six electric hoists. Two of these are 50 h.p. with single drums; two 50 h.p. with double drums; two 35 h.p. with double drums. All are to be used on the new concrete handling plant which the contractors are building this winter for use on the twin flight locks next spring.

Perpetuate New Industries.—The perpetuation of the industries which have grown up in Canada as a result of shell orders received in this country, has been taken up by the Government, according to an official statement. Following the advice of Lionel Hichens, the British shell expert, the question of assuming permanence to the great industry which has developed in the Dominion in a year has been given immediate consideration. It has been added to the duties of the Economic and Development Commission, and will be perhaps one of the most important matters to be reported on by that body.

Personal

Col. Cantley, president of the Nova Scotia Steel & Coal Co., is not going to England, as was recently reported.

Hon. Frank Cochrane, Minister of Railways and Canals, will leave this week for England. Mr. Cochrane will be away for a month, and will not be in Ottawa when the session opens.

C. C. Johnson, B.A.Sc, has been appointed resident engineer at London, Ont., representing Chipman & Power, consulting engineers, Toronto, who are responsible for the proposed sewage disposal plant.

W. J. McCormack, who has been superintendent for the Northern Navigation Co. at Sarnia, Ont., for some years past, has been appointed manager of the steamers operated by the Algoma Central Railway Co., with headquarters at Sault Ste. Marie, Ont. Mr. McCormack will assume his new duties the first of the year.

M. L. Allard, of Toronto, assistant superintendent of the Dunlop Tire & Rubber Goods Co., was a passenger on board the Japanese liner Yasaka Maru, torpedoed in the Mediterranean. Mr. Allard is safe at Port Said, but has lost everything, including his letters of credit. Mr. Allard has been making a tour of Europe on behalf of the Dunlop Company, and was on his way to the Far East.

Foreman Honored.—A token of the estimation in which William Fourney, machine shop foreman at the John McDougall, Caledonian Iron Works, Montreal, is held, was shown in the presentation by the employees on Christmas Eve of a gold watch and chain, suitably engraved. The presentation was accompanied by an address which referred to Mr. Fourney's consideration for his men and faithful performance of his duty towards the firm.

Tenders

Grand Mere, Que.—Tenders are being called until January 5 for electrical equipment, including a 500-h.p. turbine and generator, switchboard, etc.

St. Hyacinthe, Que.—Tenders will be received up to January 11 for a mechanical filter plant. Plans and speci-

fications may be obtained at the office of Hector Cadieux, city engineer.

Winnipeg, Man.—Tenders will be received at the office of the Greater Winnipeg Water District, up to January 10, 1916, for the supply of rock crushing plant. Specifications and form of tender may be obtained at the offices of the district, 901 Boyd Building.

Toronto, Ont.—Tenders will be received, addressed to the Chairman, Board of Control, City Hall, up to Tuesday, January 11th, 1916, for the supply and delivery of—No. 34, red lead paint for Bloor Street viaduct; No. 74, cast iron special castings for main pumping station. Specifications and forms of tender may be obtained at the Works Department, Room 12, City Hall.

Montreal, Que.—Tenders will be received by the Board of Commissioners, City Hall, up till Tuesday, January 4, 1916, for building and erecting at Papineau Avenue pumping station one electrically-driven turbine or high lift centrifugal pump, with electric motor complete. Specifications may be obtained at the office of the superintending engineer of the Waterworks Department, City Hall.

New Incorporations

The National Cash Register Co. of Canada, Ltd., has been incorporated at Ottawa with a capital of $1,000,000, to develop the business already established in Toronto, Ont.

The Western Machinery Co. has been incorporated at Toronto, with a capital of $40,000, to manufacture all kinds of

machinery, boilers, shells, and iron and steel products, at Port Arthur, Ont. Incorporators: Richard Best Roberts, Peter Donald Munroe, and Angus McPherson, of Toronto.

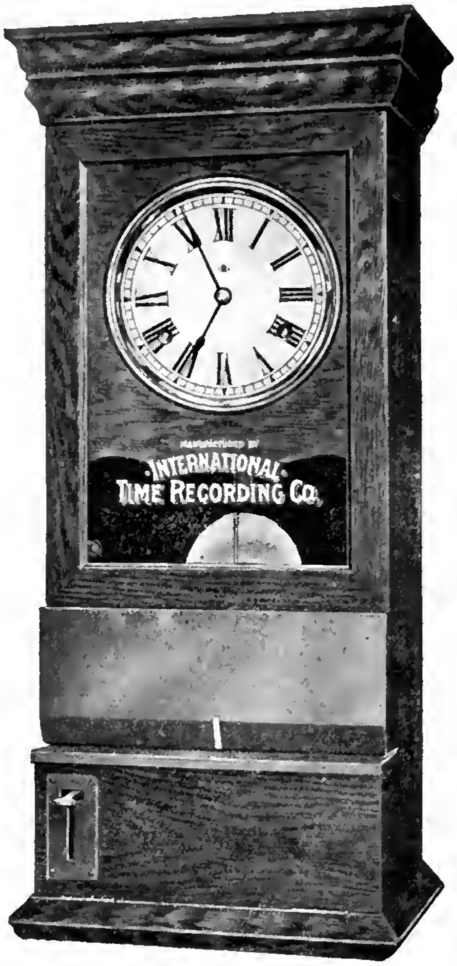
The Consolidated Steel Co. has been incorporated at Toronto, with a capital of $100,000, to carry on the business of iron founders, mechanical engineers and manufacturers of machinery, tool makers, brass founders, metal workers, etc., at Toronto. Incorporators: Wm. Hughes Beatty, Francis Arthur Hammond and Charles Bennett McClurg, all of Toronto.

The St. Maurice Paper Co., Ltd., has been incorporated at Ottawa with a capital of $10,000,000 to manufacture and produce mechanical and ground wood pulp, paper, etc. Head office at Montreal. Incorporators: Alexandre Chase-Casgrain, Errol Malcolm McDougall, and Pierre Francois Casgrain, all of Montreal, Que.

Catalogues

Heating Water With Steam is the title of a catalogue issued by the Alberger Heater Co., Buffalo, N.Y. The catalogue deals with the "Alberger" multi-head water heaters for various services and contains views of buildings and plants where they have been installed. The construction of this heater is described fully and reference is made to the efficient heat transmission. Tables for the 1915 U.S. standard pipe flanges, a table of flow of steam through pipes and a table of temperature differences are included. The catalogue concludes with a description of the Ross expansion joint which is also illustrated.

Steam Tables for Condenser Work.—The third edition of this handbook of steam tables has been published by the Wheel Condenser & Engineering Co., Carteret, N.J. The book contains 31 pages, 14 of which cover three tables, No. 1 being a vacuum table and gives properties of saturated steam from 29.8 in. of vacuum to atmospheric pressure. No. 2 is a temperature table and gives properties of saturated steam from 30 degrees to 212 degrees Fah. No. 3 is a gauge and absolute pressure table and gives the properties of saturated steam from 0 lbs. gauge pressure to 200 lbs. gauge pressure. The concluding section contains constants and tables, etc., for the correction of readings. The steam tables are based on the properties of saturated steam given in the latest tables of Marks & Davis and were especially calculated for this book by Prof. Marks.



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Book Reviews

Laboratory Tests of a Consolidation Locomotive, by E. C. Schmidt, J. M. Snodgrass, and R. B. Keller has just been issued as Bulletin No. 82 by the Engineering Experiment Station of the University of Illinois. This bulletin presents the results of a series of laboratory locomotive tests, which constitute the first work of the recently established locomotive testing laboratory of the University of Illinois. The tests were made on a typical consolidation locomotive loaned to the University of Illinois by the Illinois Central Railroad, and the data secured and the results derived therefrom are presented and analyzed in detail. Since this is the first series of tests conducted in the new laboratory, the bulletin includes a description of the laboratory equipment and the methods of testing employed. The locomotive was first tested in the condition in which it was received from service. It was then subjected to certain repairs, and again fully tested. The main purpose of the tests was to determine the general performance of the locomotive and the performance of its boiler and engines after the repairs were made and when the locomotive was in excellent condition. The secondary purpose was to study the effect of some of these repairs upon the locomotive's performance. The locomotive was worked during the tests throughout a range of speed corresponding to that which would ordinarily prevail in service. At each of the various speeds the endeavor was made to vary the cut-off throughout as wide a range as the capacity of the boiler or of the grates would permit. All tests were made with the throttle wide open. The maximum amount of dry coal fired per hour was 11,127 pounds or 224.5 pounds per square foot of grate per hour. The maximum equivalent evaporation per hour was 57,954 pounds or 17.65 pounds per square foot of heating surface per hour. The University of Illinois equipment makes possible the collection of all stack cinders and the information relative to cinder losses which is presented shows these losses to have ranged from 3 to 16 per cent. of the weight of the dry coal fired for what might be considered ordinary service conditions and to have amounted to 27.4 per cent. of the weight of the dry coal fired during one test under extreme conditions of firing and draft. Copies of Bulletin No. 82 may be obtained gratis upon application to W. F. M. Goss, Director of the Engineering Experiment Station, University of Illinois, Urbana, Ill.